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TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE C.O.R. SYSTEM IN 1919.

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THE evolution of the dairy cow in New Zealand affords an interesting subject for study. In the earliest days of our cattle industry the requirement was mainly for beef, and beef cattle were imported, the Shorthorn breed predominating. These developed to a very considerable extent throughout the country. With the advent of dairying the Shorthorn cattle were used as a foundation in the majority of herds kept for dairy purposes. Crosses of Ayrshire were first made with the Shorthorn, while during more recent years Jersey and Friesian grades have been coming very much to the front.

A review of statistics shows that of late years in our principal dairying districts the dual-purpose cow has been giving way to the special-purpose dairy breeds. From 1908 to 1918 the number of purebred Shorthorn bulls in Taranaki decreased 90 per cent., whereas the number of purebred Jersey, Friesian, and Ayrshire bulls increased 60 per cent. Taking the different land districts, the enumeration of 1918-19 shows that, for every 100 Shorthorn females two years of age and over, the corresponding figures for Jerseys, Friesians, and Ayrshires

were: Auckland, 33; Otago and Southland, 31; Wellington, 64; and Taranaki, 134. When we consider that the Shorthorns are practically the foundation of our average dairy herds the trend of breeding of dairy stock in the various districts is apparent. The 1919-20 figures will doubtless present the position in a light more favourable to the special-purpose dairy breeds, as it is well known that the Auckland Province has lately imported large numbers of grade Jerseys from Taranaki. This tendency of the cattle industry towards special-purpose dairy breeds is an indication of the healthy condition of the dairy industry. Dairy-farmers are in ever-increasing numbers realizing that only efficient dairy cows are compatible with high-priced land. The increase in land-values and smaller holdings is exerting a considerable influence in popularizing those special-purpose breeds that will produce dairy-products at the lowest cost.

Another evidence of the progress of the industry is to be found in the increased volume of cow-testing that is being carried on by dairy farmers and breeders. Never before in the history of dairying in New Zealand has the tendency in this direction been so marked. The progress made in association testing of grade cattle is a very encouraging feature. While this phase of testing enables the herd-owner to cull out uneconomical producers, its effect in saving the best producers, and more especially in inducing the owner to breed better, is the more important. Ultimately our dairy herds can only be intrinsically improved by better breeding. When a cow-testing association member studies the butterfat production of his individual cows, and is thereby induced to purchase a butterfat-record purebred bull, the testing has accomplished a great work on his behalf, and indirectly is a means of increasing the wealth of the Dominion.

The number of breeders entering cows for certificate-of-record test has continued to evidence an ever-widening interest in the work. During the present season testing officers are paying monthly visits to some 202 breeders as compared with 155 last year, an increase of about one-third.

EXPORT OF PUREBRED DAIRY CATTLE.

If further evidence of the progress of the dairy industry as affected by testing be required it will be found in the export of purebred stock. Our records of purebred dairy cows has attracted the attention of breeders in Australia and in some of the Pacific islands. Some sixty-one head of New Zealand Friesians, valued for Customs purposes at £3,045, were shipped last year, and others were purchased for later shipment. While some of these animals were of such superior quality that we can ill afford to lose them, their work for their new owners should be so pleasing as to further popularize New Zealand strains abroad, and be conducive to further profitable business.

NINE-HUNDRED-POUND BUTTERFAT RECORDS.

At the beginning of the year under review the Register of Merit had one cow in the 900 lb. butterfat class. This was Westmere Princess Pietertje, the leader of the junior four-year-old class for Friesians. During 1919 Burkeyje Sylvia Posch qualified for the 900 lb. class, and became leader of the mature class for her breed.

Sultan's Daisy very worthily represents the Jerseys in the list of animals attaining this 900 lb. butterfat distinction. Her record was produced with twice-a-day milking, and constitutes a New Zealand if not a world's record under such conditions.

Mutual Pearl of Rock (Friesians) was on test during the year. She completed her milking-period with a production entitling her to a place with the three cows referred to, but as she qualifies on subsequent calving during 1920 she is to be credited to that year.

Special comment has been made in previous issues of the *Journal* on the animals which have received certificates for production in the 900 lb. class, and interested readers will be familiar with the details.

PROGRESS AS INDICATED BY CERTIFICATES ISSUED.

The total number of certificates issued shows a satisfactory increase over that for the previous year. The number of ordinary certificates issued—259—is sixty-three above that of the preceding year. This increase amounts to 32 per cent., and is in harmony with the percentage of increase of testing breeders already referred to. It is apparent that the number of certificates received per testing breeder maintains considerable uniformity. While it would be less expensive to carry on the testing-system were the increase found in the number of cows tested per breeder, the existing conditions widen the influence exerted by the testing and doubtless make it a more potent factor for dairy-herd improvement.

Certificates have now been granted on the production of 1,260 registered cows. As the number increases, the amount of information the records will afford to breeders in particular and to dairymen in general will be more valuable to them in formulating breeding plans and "grading up" the average dairy cow. The following table indicates the general position:—

Breed.	1913.	1914.		1915.		1916.		1917.		1918.		1919.	
		Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.
Jersey ..	67	104	14	91	4	94	11	94	13	113	8	150	14
Friesian ..	48	67	11	62	9	44	5	62	14	57	14	54	7
Ayrshire ..	..	17	1	12	1	9	..	4	3	4	..	2	..
Milking Short-horn ..	..	..	..	2	..	7	..	21	..	22	..	53	3
Totals ..	115	188	26	167	14	154	16	181	30	196	22	259	21

FRIESIANS.

The black-and-whites have not been so long established in New Zealand as have the other dairy breeds. With the building-up of any breed the principal difficulty is in supplying new breeders with purebred foundation females of the best ancestry and quality. New Zealand is not in a position to import from the United States or Holland, owing to adverse import regulations. Breeders, however, have been strengthening their herds by breeding from the strains

already represented in our purebred herds prior to the war. A number of strains have been coming to the fore through high production. It is believed we have some of the best Friesians existing, and that intelligent breeding during the next decade should place the New Zealand black-and-whites "in the limelight" to an even greater extent than is the case to-day.

Class-leaders.

During the year two of the 1918 class-leaders have been superseded. In the junior three-year-olds Ethel of Friesland Park, with a C.O.R. for 17,663·2 lb. milk, containing 638·85 lb. butterfat, has been replaced by Rosevale Holland Queen, owned and tested by H. North and Sons, Omimi. She has qualified for a C.O.R. on a production of 657·39 lb. butterfat, thus raising the class leadership by 19·46 lb.

Holland Queen, who was class-leader for a number of years, has been replaced for the leadership of the mature class by the Canadian-bred cow, Burkeyje Sylvia Posch. The latter cow also replaces Westmere Princess Pietertje as New Zealand champion milk- and butterfat-producer.

With these exceptions the 1918 class-leaders have retained their places. The 1919 leaders constitute a most creditable list, two being in the 900 lb. butterfat class, two in the 800 lb. class, one in the 700 lb. class, and the leaders of the junior two-year-olds and junior three-year olds in the 600 lb. class.

Following is a complete list of the class-leaders for 1919:—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Junior Two-year-old.</i> Princess Pietertje de Kol	R. Melvin, jun., Masterton	Y. dys. 2 102	lb. 250·7	365	15,577·80	626·82
<i>Senior Two-year-old.</i> Netherland Princess IV	J. Donald, Westmere	2 341	274·6	365	19,621·60	805·77
<i>Junior Three-year-old.</i> Rosevale Holland Queen	H. North and Sons, Omimi	3 165	293·5	365	16,016·30	657·39
<i>Senior Three-year-old.</i> Manor Beets Daughter II of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·90	863·51
<i>Junior Four-year-old.</i> Westmere Princess Pietertje	J. Donald, Westmere	4 156	329·1	365	24,199·00	939·78
<i>Senior Four-year-old.</i> Woodcrest Johanna Tehee	J. Donald, Westmere	4 325	346·0	365	21,483·10	754·96
<i>Mature.</i> Burkeyje Sylvia Posch	H. North and Sons, Omimi	6 129	350·0	365	26,226·00	983·20



BURKEYJE SYLVIA POSCH.

Leader of the Friesian mature class, and champion milk and butterfat cow of New Zealand.



INKA SYLVIA BEETS POSCH.

Sire of Burkeyje Sylvia Posch. Sire also of May Echo Sylvia and other famous Canadian dairy-cattle. At time of death owned by the Agassiz Experimental Farm, British Columbia.

Class-averages.

The number of females qualifying for certificates shows a falling-off of about 14 per cent. This is a feature which will doubtless claim the serious attention of the Friesian Association. To an outsider it would appear that there is room for a constructive forward movement. That the Friesian has proved one of the foremost dairy breeds in New Zealand, as well as elsewhere, there can be no doubt. There appears to be ample room to exploit the breed in New Zealand to the advantage of the Dominion and the Friesian breeders as well.

In four of the seven classes into which this breed is divided according to age the average yield has been substantially increased during the past year. The classes for the mature animals and junior and senior two-year-olds are in receipt of stronger support than are the classes for three- and four-year-olds. It is pleasing to see that both classes for two-year-olds show increased production.

The tabulated figures for 1919 and 1918 respectively are as follows:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
		1919.	lb.	lb.
Junior two-year-old ..	12	350	11,713·8	417·68
Senior two-year-old ..	11	358	13,393·1	482·24
Junior three-year-old ..	6	358	13,781·1	502·37
Senior three-year-old ..	4	327	12,154·3	410·00
Junior four-year-old ..	8	349	14,786·6	514·27
Senior four-year-old ..	2	287	13,150·5	468·57
Mature	18	334	15,064·0	523·59
		1918.		
Junior two-year-old ..	18	349	11,281·0	407·32
Senior two-year-old ..	10	345	9,982·3	374·06
Junior three-year-old ..	5	351	13,101·1	465·05
Senior three-year-old ..	6	331	14,493·5	487·38
Junior four-year-old ..	5	365	15,779·1	576·13
Senior four-year-old ..	7	363	13,469·3	480·97
Mature	20	349	14,600·4	528·14

C.O.R. Bulls.

During the year the names of three bulls have been added to the list of those that have four C.O.R. daughters from as many different dams. Mutual Piebe of Rock (Imp.) is one of this trio, and had more daughters to win a C.O.R. during the year than had any other bull in the complete list. Two daughters of Woodcrest Hengerveld Mechthilde (Imp.) qualified during the year, thus raising his total to five. King of the Dominos, recently sold at Mr. Lovelock's sale to Mr. Neil Carter, has also qualified for the list with an increase of two daughters

during the year, making his total now four. The list at the end of the year stands as follows:—

Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1919.	Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1919.
Cliffside Laddie ..	17	2	Edinglassie ..	7	..
King Segis Wild Rose Homestead	15	1	Mutual Piebe of Rock*	7	6
Sir de Kol Inka Pie- tertje	14	1	Colonel Manor of Riverside	6	..
Kruger II ..	13	..	Colantha Johanna Lad	5	1
Longbeach Van Tromp	12	2	Dominion de Kol	5	..
Grace's Netherland of Riverside	10	..	Domino	..	..
Nazli de Kol ..	10	..	Oak de Kol II Home- stead Fobes	5	..
Paul Pietertje ..	9	..	Woodcrest Hengerveld	5	2
Mutual Piebe de Kol	9	2	Mechthilde*	..	..
Prince Pietje Paxton	9	2	Netherland King ..	4	..
De Kol Pontiac Burke	8	..	Pietertje Boy ..	4	..
King Fayne Segis II	8	3	Longbeach Dutchman	4	..
			King of the Dominos*	4	2

* Qualified during 1919

JERSEYS.

The development of the Jersey in New Zealand has been intensely fostered for a longer period than has been the case with any of the other special-purpose dairy breeds. It would be a reasonable expectation, therefore, that they should be represented in our certificate-of-record work in greater numbers than the Friesians, Milking Shorthorns, or Ayrshires. Such is certainly the case, and from the Jersey breeders' point of view a most satisfactory feature is that a substantial proportion of the certificates going to the breed are claimed by junior two-year-olds, which include heifers up to the age of 2 years 92 days.

Class-leaders.

The Jerseys are divided into five classes. Only in the two-year-olds are there juniors and seniors, the former including all animals up to 2 years 92 days, and the latter those 2 years 93 days and under 3 years of age.

Madam Mayflower has held the leadership of the mature class for several years. She is now replaced by Sultan's Daisy, who increases the record for the class leadership by over 200 lb. of butterfat. This is a remarkable advance in the figures, and the yield of Sultan's Daisy attracts even more attention by being over 230 lb. of butterfat in excess of the next highest class-leader. Not only does Sultan's Daisy become the mature-class leader, but her record also entitles her to the title of New Zealand champion Jersey butterfat-producer.

Woodstock's Baby has joined the list of class-leaders this year by replacing Sultan's Clematis in the class for three-year-olds. This has raised the maximum for the class by some 16 lb. of butterfat.

The record of Mere, made as a yearling, in the junior two-year-old class, still stands as the class-leadership, and is higher than that of the other classes under four years.

The 1919 class-leaders are,—

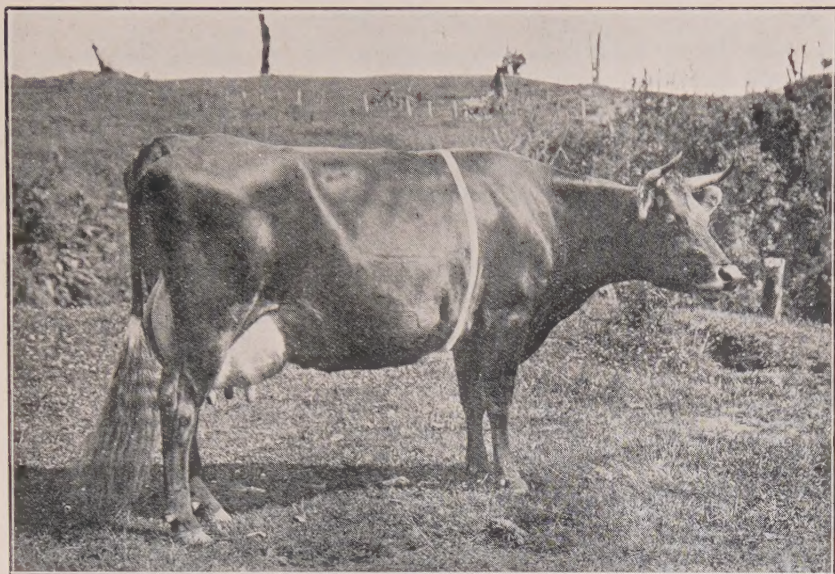
Name of Cow and Class.	Tested by	Age at starting Test.	Fat red'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Junior Two-year-old.</i>		Y. dys.	lb.		lb.	lb.
Mere	F. S. McRae, Palmers-ton North	1 346	240·5	365	12,164·00	663·64
<i>Senior Two-year-old.</i>						
Lady Peggy ..	E. Griffiths, New Ply-mouth	2 357	276·2	365	9,625·50	650·00
<i>Three-year-old.</i>						
Woodstock's Baby ..	Mrs. A. Banks and Son, Kiwitea	3 302	307·2	365	12,329·70	657·91
<i>Four-year-old.</i>						
Lady of Collingwood	The late F. E. Hellyer, Dunedin	4 86	322·1	365	12,096·50	736·07
<i>Mature.</i>						
Sultan's Daisy ..	E. O'Sullivan and Sons, Tariki	6 344	350·0	365	13,502·70	968·22

Class-averages.

The Jersey classes, without exception, represent creditable increase in numbers of animals receiving certificates. The average number of days in milk for heifers in the junior two-year-old class and cows in the mature class are the same as those indicated for these classes for 1918. The average milking-period for the three-year-olds and four-year-olds is somewhat shorter. Despite this the average yield for each of these classes shows an increase. Although the classes for senior two-year-olds and mature cows show a little reduction in yield for the average of each class, the increases in production in the other three classes are much more marked. The general position in this respect is therefore eminently satisfactory.

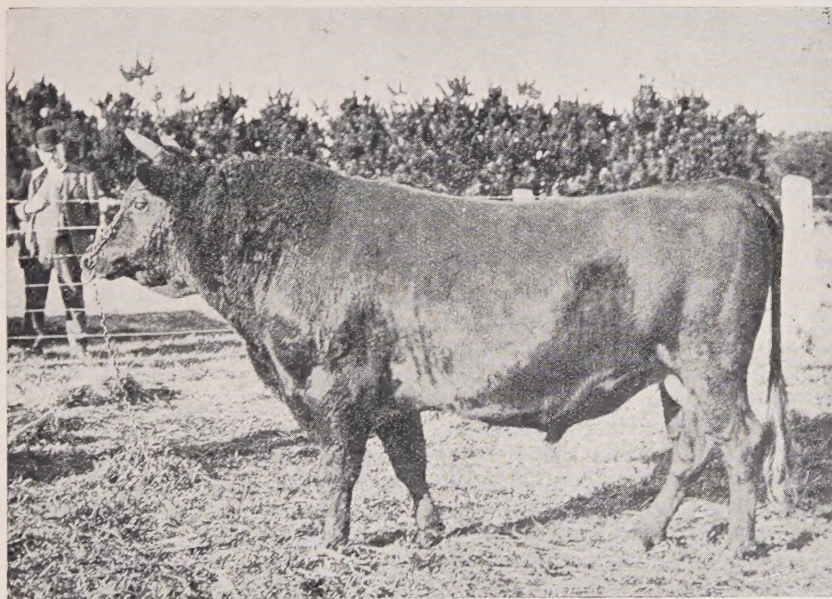
The figures for 1919 and 1918 are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
1919.			lb.	lb.
Junior two-year-old	.. • 62	343	6,579·00	369·93
Senior two-year-old	.. 20	345	6,915·30	402·07
Three-year-old	 27	337	7,815·40	442·42
Four-year-old	 18	329	8,183·10	467·25
Mature	 37	344	8,555·40	470·40
1918.				
Junior two-year-old	.. 50	343	6,321·85	356·29
Senior two-year-old	.. 14	341	7,332·20	408·34
Three-year-old	 17	345	7,451·60	416·66
Four-year-old	 14	340	8,062·94	448·41
Mature	 26	344	8,604·01	475·26



SULTAN'S DAISY.

Leader of the Jersey mature class, and champion Jersey cow of New Zealand.



CAMPANILE'S SULTAN.

Sire of Sultan's Daisy and other C.O.R. cows.

C.O.R. Bulls.

Nine Jersey bulls have been added to the list during the year. Of the new bulls, Soumise Majesty has added four C.O.R. daughters, making his total now stand at seven. Admiral of Puketapu, whose name appeared in the 1918 list, has an accretion of six certificated daughters during the year, making his total stand at fifteen. This pairs him with Roberts for fourth place in the list of forty-one bulls, which is as follows:—

Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1919.	Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1919.
Majesty's Fox ..	24	..	Sunflower's Perseus*	6	2
K.C.B. ..	22	..	Lord Lepperton ..	5	..
Eminent's Fontaine ..	22	3	M.H.R. ..	5	1
Roberts ..	15	2	Brighton Twylish ..	5	1
Admiral of Puketapu	15	6	Silver King (Stuckey's)	5	..
Fancy's Lord Twylish	10	3	Belvedere Butter Boy	5	..
Campanile's Sultan ..	9	1	Good Luck ..	4	..
M.L.C. ..	9	1	Glory ..	4	..
Starbright ..	9	..	Young Emperor III	4	..
Rozel's Sultan ..	9	..	Fancy's Carnation's	4	..
Bilberry's Goddington	9	5	Fox	..	..
Blizzard ..	7	..	Marcus* ..	4	1
Frisky Campanile ..	7	1	Knight Commander..	4	..
Soumise Majesty*	7	4	Farleigh Fox*	4	3
Pride of Egmont ..	6	..	Nestor of Willowbank*	4	3
Stevenson ..	6	..	Petune's Noble*	4	2
Goddington ..	6	..	Sunlight's Noble	4	3
Golden Swan ..	6	..	General*	..	..
Grand Duke ..	6	..	Silverlock's Duke* ..	4	1
Mabel's Dairyman ..	6	..	Bush Boy* ..	4	3
Molina's General ..	6	..	Yankee Sweet* ..	4	2
Charm's Lord Twylish	6	1			

* Qualified during 1919.

MILKING SHORTHORNS.

Members of the Milking Shorthorn Association have been taking advantage of the C.O.R. testing facilities in a manner which surpasses all previous efforts. Many dairymen will be pleased to see this breed of British origin qualify for a secure position in New Zealand dairying. It would appear that it is only an extensive patronage of certificate-of-record testing that will assure this. The show-ring is being patronized by the Milking Shorthorn breeders as well as by members of the other cattle-breeders' associations. The demand which the shows are making for straight-lined animals, together with the inherent desire of many Milking Shorthorn breeders for long pedigrees, appears to have a tendency to induce some breeders to develop the "shorthorn" characteristics rather than the "milking" factors. As the case presents itself to us, only the C.O.R. testing can act as an effective brake against such a trend becoming too general.

The enthusiastic support which many of the Milking Shorthorn breeders are giving the yearly testing is bringing a number of their animals into prominence. The proportion of C.O.R. females is in need of very considerable increase, since there are more owners of registered Milking Shorthorns than there are members of any of the "special-purpose" dairy-breed associations. As the testing extends it may be possible for young dairymen to buy registered Milking Shorthorn bulls that are from C.O.R. dams, and are sired by a registered bull of a dairy strain and who has a dam with a satisfactory C.O.R. From the point of view of improving the yield of the average herd cow such a record behind the young bull's sire is likely to suit the dairyman better than a long beef pedigree.



DOMINION EMPRESS V.

A C.O.R. member of the Ruakura Milking Shorthorn herd.

Class-leaders.

The leadership of the four classes of Milking Shorthorns has experienced a change in the four-year-olds during the year. Cora, owned and tested by the Ruakura Farm of Instruction, has been superseded by Matangi Strawberry II, owned and tested by Messrs. Ranstead Bros. The work which the latter have been doing with their test cows has doubtless tended to popularize the breed very considerably. With one of their cows they were a strong competitor for the leadership of the mature class. This honour appears to be strongly held by Willowbank Beauty, who is the only leader in the 600 lb. butterfat class.

The leaders as they stood at the end of 1919 are,—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Two-year-old.</i> Joyce II of Hillview	W. Wright, Matapu, Hawera	Y. dys. 2 215	lb. 262·0	365	lb. 9,860·00	lb. 365·34
<i>Three-year-old.</i> Dominion Daphne V	Central Development Farm, Weraoa	3 303	307·3	354	11,033·60	427·90
<i>Four-year-old.</i> Matangi Strawberry II	Ranstead Bros., Matangi	4 351	349·6	365	12,774·60	473·50
<i>Mature.</i> Willowbank Beauty	S. G. Morgan, Ngawapurua	*	350·0	365	15,725·80	655·22

* Mature

Class-averages.

This is the first year that the Milking Shorthorn breed has had sufficient numbers tested and qualified for certificate of record to warrant the compilation of the average production of each class. We are not in a position, therefore, to give comparisons between the work of this and preceding years.

It will be noted that the mature class has been fairly strongly supported. Interest in testing should be increased as the female progeny of these mature cows come into profit and under test. Although the class-averages are not quite so high as those of the other breeds some of the supporters of Milking Shorthorns hope to make a better showing when they have had more time to segregate their dairy strains from those representing beef. The elimination of the beef inheritance should have an influence in the direction desired by the dairyman and the breeder who is catering for the dairyman's requirement. If this can be successfully accomplished these class-averages should show an annual improvement.

The table of figures for the year is as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
Two-year-old	7	351	lb. 7,238·6	lb. 294·92
Three-year-old	3	352	8,388·7	339·62
Four-year-old	6	331	10,499·9	423·38
Mature	40	334	10,748·5	425·65

AYRSHIRES.

The year has scarcely evidenced the increase in the testing of Ayrshires that we desired. During 1918 three breeders were on our testing officers' programmes. Two of these discontinued, but three

others came in, leaving the total at four in 1919. Now that testing is becoming more firmly established each year it is to be hoped we shall have an increase in the number of testing Ayrshire breeders compatible with the worth of the breed to the dairying industry.

Bluebell of Riverside, owned and tested by C. B. Morgan, of Ngawapurua, annexed a C.O.R. on a production of 526.15 lb. butterfat. With this she supersedes Adelaide II of Waipapa as leader of the three-year-old class, and raises the class-leadership by 100 lb. butterfat. All four class-leaders are now in the 500 lb. list.

The dam of Bluebell of Riverside was sired by a son of Victor, who is said to have been a bull above the average in transmitting factors for production. On the sire's side of the pedigree appear the names of Rita, Fascination, and Ada III, matrons which have been recognized as heavy producers, although they have never been on C.O.R. test.

The production of Bluebell of Riverside should encourage breeders of this and other good strains of Ayrshires to undertake the authenticating of records of other individuals of the known good lines.

Two certificates of record were issued to Ayrshires during the year. In addition to the one received by Mr. C. B. Morgan on the production of Bluebell of Riverside, Mr. A. H. Hansen's Princess II of Porirua received a certificate for 483.63 lb. butterfat in the mature class. The number of Ayrshire cows receiving certificates is so small that we are not in a position to publish class-averages as has been the case with the other breeds. The statement of the class-leaders at the end of the year is as follows :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Two-year-old.</i>		Y. dys.	lb.			
Kanadale Linda ..	Cockburn Bros., Ma- tura	2 348	275.3	365	12,583.00	502.55
<i>Three-year-old.</i>						
Bluebell of Riverside	C. B. Morgan, Ngawa- purua	3 14	278.4	365	11,229.00	526.15
<i>Four-year-old.</i>						
Alexandra of Waipapa	F. Mills, Waipapa, Hawera	4 348	348.3	365	14,348.60	591.16
<i>Mature.</i>						
Alexandra of Waipapa	F. Mills, Waipapa, Hawera	6 354	350.0	365	14,636.00	582.47

SECOND-CLASS CERTIFICATES.

Breeders who have been testing cows for certificates of record have been at some inconvenience in publishing either in sale catalogues or in advertisements the records of tested cows which failed to get certificates owing to calving a few days late after test. The suggestion that second-class certificates might be granted was made. The matter was discussed with the executives of the principal breeders' associations

co-operating in the work, safeguards were decided upon, and what appears to be a satisfactory working arrangement was approved by the executives and later by the Department. This arrangement is embodied in the new rules, a copy of which has been forwarded to each testing breeder. The second-class certificate will be forwarded to the owner of a cow qualifying for same as from the 1st January, 1920.

APPRECIATION.

The development in the testing-work among breeders of registered dairy stock has very considerably increased the work of the secretaries of most of the associations concerned. They sign applications to the effect that the cow being entered for test is registered in the records of the respective associations. They receive copies of the certificates, and after tabulating these the secretaries of the Jersey and of the Friesian associations prepare their copy for those excellent publications, the "Jersey Advanced Register of Merit" and the "Friesian Year-book." In at least one secretary's office tables of the monthly records are prepared for publication in the official organ of the association. The correspondence of the secretaries has been increased, and to this has been added the issuing of forms connected with the entry of C.O.R. animals in classes for C.O.R. cows at some of the agricultural shows.

The manner in which the secretaries have co-operated with the Dairy Division has been most pleasing and is gratefully acknowledged. The enthusiastic support and sympathetic interest of the executives of the associations has tended to make the work profitable to the Dominion and encouraging to the breeders.

The success of the C.O.R. testing-system depends very largely on the integrity of the testing officers. Their hours of duty are early and late, in all kinds of weather. Their devotion to duty and their straightforward conduct have assisted in a marked degree towards the success attained.

CLOSING LIST OF RECORDS FOR 1919.

In the appended concluding list for the year are some very fine records among both the Friesians and the Jerseys, while the Ayrshires contribute one of special merit.

H. North and Sons have received certificates on three Friesian records. In the junior two-year-old class Rosevale Stella stands highest in the list. She is from Helena Plus Girl, which was imported from Canada. The sire of this imported cow was from a dam with a record of 22,304 lb. of milk, containing 764.94 lb. butterfat. The sire of Rosevale Stella is Netherland King of Rosevale. This bull is a son of Longbeach Netherland Queen VII, who has a certificate of record for 659.31 lb. butterfat.

The list also contains two other very creditable records made by animals owned by Messrs. North. These cows are Rosevale Rhoda Posch and Rosevale Pietje Korndyke. They are both in the four-year-old class, and each is sired by Bruce of Pleasant Valley, who was imported from Canada. His sire has a number of tested daughters, and his dam is from a cow that has produced at least two tested daughters. One of these has a record of 575 lb. butterfat. Each of these four-year-olds is from a Canadian-bred dam.

Dutchland Colantha Cadillac has completed a good record in the mature class. She had been on test previously, but on subsequent calving failed to get a certificate for her production of 18,739.7 lb. milk, containing 670.63 lb. butterfat. She is a daughter of Colantha Johanna Lad, and was imported by W. I. Lovelock. At Mr. Lovelock's recent sale she was purchased by the Bloomfield Farm Company at 212 guineas, a price that was exceeded at this sale only by her daughter, Colantha Lass of Conemaugh, at 220 guineas.

Among the Jersey figures of this list will be seen the records of two three-year-olds in the 600 lb. class and one 500 lb. record in the mature class. The highest credit was won by Woodstock's Fancy Free. This is her second year on test. Her previous record was started on her second birthday, and she won a certificate for a production of 630.15 lb. butterfat. During her second lactation period she has improved this by 10.88 lb fat. Woodstock's Fancy Free is a daughter of Fancy's Lord Twylish from a daughter of Eminent's Fontaine. Fancy's Lord Twylish has now ten C.O.R. daughters, and Eminent's Fontaine twenty-two. The maternal grandam of Woodstock's Fancy Free is by Duke of York, who sired three C.O.R. daughters, including Lenora, who won a certificate for 685.18 lb. butterfat.

Mr. Dermer bred the dam of Woodstock's Fancy Free, and he also bred Waipiko Lena, the other 600 lb. three-year-old figuring in this list. Waipiko Lena was sold at Mr. Dermer's sale, and completed her record at G. McKenzie's, Waitara. She is from Eminent's Lenora, a 518.59 lb. butterfat daughter of Lenora by Eminent's Fontaine. Waipiko Lena was sired by Bilberry's Goddington, who now has nine C.O.R. daughters, among which Waipiko Lena has the best record. The dam of Bilberry's Goddington is by K.C.B., who now has twenty-two C.O.R. daughters.

A somewhat different line of breeding is responsible for Neat Olga, in the mature class, who has produced 583.25 lb. butterfat. She is a line-bred Campanile Sultan cow, her sire, Mermaid Sultan, being a son of this imported bull and her dam a granddaughter. Mermaid Sultan has now four C.O.R. daughters. A four-year-old daughter, Sultan's Lass, has a certificate for 580.4 lb. butterfat.

Yankee Sweet, who was sire of the dam of Neat Olga, has four C.O.R. daughters. Michaelmas Day has the highest record among these, at 480.87 lb. butterfat. The record of Sultan's Daisy will have materially strengthened any pedigree such as that of Neat Olga's. Sultan's Daisy, with her record of 968.22 lb. butterfat, is half-sister to Neat Olga's sire and to her maternal grandam.

The record made by Bluebell of Riverside has been commented on in the annual review.

LIST OF RECORDS.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
<i>Junior Two-year-old.</i>		Y. dys.	lb.		lb.	lb.
Duchess of Woodstock	Mrs. A. Banks and Son, Kiwitea	2 61	246.6	365	8,319.0	430.45
Renown's Carnation	F. J. B. Ryburn, Paterangi	2 25	243.0	365	6,264.7	299.38
Successful Queen ..	Mrs. C. A. McKenzie, Carnarvon	2 42	244.7	283	4,532.6	256.32
Charm's Sensation ..	G. Buchanan, Paeroa	1 133	240.5	342	5,591.2	248.30
<i>Senior Two-year-old.</i>						
La Poupee ..	F. J. B. Ryburn, Paterangi	2 266	267.1	365	7,021.5	426.06
Waipiko Geraldine ..	J. Haskins, Manutuke	2 339	274.4	347	6,284.7	356.80
Dominion Myrtle of Ruakura	Ruakura Farm of Instruction, Hamilton	2 358	276.3	365	5,183.8	334.08
<i>Three-year-old.</i>						
Woodstock's Fancy Free	Mrs. A. Banks and Son, Kiwitea	3 60	283.0	365	12,234.4	641.03
Waipiko Lena ..	G. McKenzie, Motunui	3 128	289.8	365	10,474.4	622.37
Waipiko Penelope ..	A. H. Guy, Kaponga	3 93	286.3	365	9,103.5	498.34
Melia Ann's Sweet ..	W. T. Luxton, Waitara	3 343	311.3	365	6,852.0	436.50
Gold Ring ..	H. R. Benbow, Ormondville	3 276	304.6	365	6,804.2	406.94
Waipiko Lucia ..	J. Haskins, Manutuke	3 7	277.7	331	6,650.7	326.07
<i>Mature.</i>						
Neat Olga ..	T. Linn, Mangatoki ..	5 11	350.0	365	9,778.3	583.25
Belvedere Cowslip ..	E. B. Eagle, Belvedere	9 40	350.0	365	9,374.8	481.54
Young Sybil II ..	S. R. Lancaster, Palmerston North	11 30	350.0	365	9,989.9	475.19
Zena ..	S. R. Lancaster, Palmerston North	9 23	350.0	271	7,531.9	397.70
FRIESIANS.						
<i>Junior Two-year-old.</i>						
Rosevale Stella ..	H. North and Sons, Omimi	2 91	249.6	365	15,581.9	544.98
Newton Queen Segis	C. A. Fawcett, Clevedon	2 15	242.0	343	10,266.3	347.65
<i>Senior Two-year-old.</i>						
Bainfield V ..	W. D. Hunt, Invercargill	2 218	262.3	365	10,807.2	396.03
<i>Junior Three-year-old.</i>						
Bainfield No. 9 ..	W. D. Hunt, Invercargill	3 11	278.1	365	14,169.6	455.46
Dominion Cornella II	Central Development Farm, Weraroa	3 73	284.3	365	10,330.75	368.64
<i>Senior Three-year-old.</i>						
Segis II Morning Rose	P. Nisbet, Rata ..	3 288	305.8	277	10,976.0	367.51
<i>Junior Four-year-old.</i>						
Rosevale Rhoda Posch	H. North and Sons, Omimi	4 74	320.9	365	20,693.7	645.36
Rosevale Pietje Korn-dyke	H. North and Sons, Omimi	4 73	320.8	365	17,045.4	572.27
Dominion Queen Elizabeth	Central Development Farm, Weraroa	4 51	318.6	344	12,006.0	388.01

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS—continued.						
Mature.		Y. dys.	lb.		lb.	lb.
Dutchland Colantha	W. I. Lovelock, Pal-	9 203	350.0	365	16,380.0	581.68
Cadillac	merston North					
Clothilde Mercena de	C. A. Fawcett, Cleve-	6 233	350.0	323	12,410.4	457.66
Kol II	don					
Dominion Domino's	Central Development	8 0	350.0	361	12,518.5	427.56
Pride	Farm, Weraroa					
Woodcrest Daisy ..	Ditto	7 239	350.0	309	12,449.5	390.22
MILKING SHORTHORNS.						
Two-year-old.						
Dominion Myth of	Ruakura Farm of In-	2 276	268.1	343	8,032.2	333.95
Ruakura	struction					
Dominion Sally of	Ditto	2 322	272.7	365	7,759.7	332.52
Ruakura						
Lady Clarence ..		2 333	273.6	325	8,027.3	326.68
Dominion Profit of		2 310	271.5	365	6,428.1	274.37
Ruakura						
Dominion Welcome of		2 223	262.8	343	6,434.7	262.92
Ruakura						
Mature.						
Heatherlea Brownie	H. M. Essex, Levin ..	*	350.0	321	9,975.8	401.41
Cloverlea Fancy A2..	A. Parkinson and Son,	*	350.0	280	10,989.8	399.98
	Opotiki					
Empress V ..	Ruakura Farm of In-	*	350.0	331	9,412.35	399.51
	struction					
Pukepai Strawberry	H. M. Essex, Levin ..	*	350.0	349	10,977.1	385.37
Kelvin Side Lizzie ..	Groves Bros., Woodville	*	350.0	245	9,277.9	359.88
Lady Jane ..	C. Lassen, Hastings ..	*	350.0	333	9,504.4	368.00
Waitangi Primrose ..	A. J. McGovern, Kio-	*	350.0	315	9,083.6	358.02
	kio					
AYRSHIRES.						
Three-year old.						
Bluebell of Riverside	C. B. Morgan, Ngawa-	3 14	278.4	365	11,229.0	526.15
	purua					

* Mature.

Professor R. D. Watt, who occupies the Chair of Agriculture at Sydney University, visited the Ruakura Farm of Instruction last month. In connection with Green's Ruakura Oat, he mentioned that this variety was now very extensively grown in Australia.

Fellowship of the New Zealand Institute.—Among the twenty Original Fellows of the Institute, recently elected, are Dr. L. Cockayne, F.R.S., and Mr. B. C. Aston, F.I.C., both of whom are well known to readers of the *Journal* by their contributions.

AN ECONOMIC INVESTIGATION OF THE MONTANE TUSSOCK-GRASSLAND OF NEW ZEALAND.

V. REGENERATION OF GRASSLAND AFTER DEPLETION.

Dr. L. COCKAYNE, F.N.Z.Inst., F.R.S.

GENERAL.

IN article II of this series* an account was given of some of the stages in the evolution of depletion, and it was shown that the presence of the rabbit in excess, and an especially dry climate, were the major factors, while a minor though an important factor was excessive burning of the tussocks. To these causes I would add, as the result of recent field-work, the extensive dying-out of the tussock in certain localities through presumably the attack of the white grub (larva of *Odontria zealandica*); nor should the effect of overstocking by sheep be underestimated.

In this article the reverse side of the picture is presented in an account of certain specific cases of regeneration in the depleted areas of the South Island, especially Central Otago. These examples, with but one exception, are taken from what may be styled "unpremeditated experiments," certain areas—usually small—of depleted grassland having been fenced from rabbits for the protection of orchards, cultivation of crops, experimental forestry, or other purposes. In some cases small portions of the fenced-in areas have not been interfered with, and there examples of regeneration occur; in other cases regeneration has taken place over the whole area; finally an example is given where regeneration has come about in the presence of cattle, sheep, and horses, but under circumstances where a good deal of food more palatable than the regenerating tussocks was available.

Unfortunately, in the examples cited there is no record of the progress of events, nor are details procurable regarding the exact degree of depletion of the area at the time of its enclosing, nor of the species then composing the plant-covering; all that can be stated is the condition of the new vegetation at the time of its examination. All the same, the facts thus brought to light are of no small economic value, for they form a basis for arranging the all-important detailed experimental work which is essential for further advance.

As explained in article IV of this series, it is not known whether regeneration is due to plants arising from seeds, or to plants already in the ground at the time it was enclosed by the rabbit-proof fence. A solution of this simple problem is much needed; for, if it turns out that regeneration may arise from seedlings, a powerful weapon is to hand with regard to the regrassing of Central Otago. The foregoing

* Published in the *Journal* for September, 1919.

remarks apply only to the indigenous species. Evidence is accumulating that certain introduced grasses, clovers, and other plants, at times—possibly frequently, indeed—gain the enclosed areas through seed carried from without. In this article cases of this kind are suggested.

Before proceeding to the detailed accounts of examples of regeneration noted by me I must take this opportunity of recording my great obligations to Mr. R. K. Smith, of Tarras, in this and many other matters concerning sheep-farming in Central Otago. Mr. Smith spent a long day in motoring me round the Tarras district, showed me several important examples of regeneration at different stages, gave me an opportunity of seeing various classes of grassland and cultivation, and on various occasions since has supplied me with much valuable information—otherwise unobtainable—the result of his many years' critical experience of Central Otago. To Mr. D. Middleton, of Northburn Station, near Lowburn Ferry, who has also assisted me in many ways and shown me much of great moment, I must likewise record my hearty thanks. I am also greatly indebted to Mr. H. E. Cameron, of Hakataramea, who motored me to his Glen Avon Station, Upper Ahuriri Valley, and pointed out place after place of interest along the road, with the history of which concerning rabbits, burning, and stocking he was fully acquainted.

SOME SPECIAL EXAMPLES OF REGENERATION.

(1.) *Mr. R. K. Smith's Farm, Tarras.*

Near his new homestead Mr. R. K. Smith has made an important experimental plantation of various kinds of trees. These receive no mention here, as tree-growing—a most important matter with regard to regeneration—should form the subject of a future article. The special point to note is that the plantation is surrounded with a rabbit-proof fence, which was put up about six years ago. The ground is flat.

I have no exact details of the pasture-plants present. The important fact, however, is that there is a great deal of blue-grass (*Agropyron scabrum*). As usually seen in montane tussock-grassland throughout New Zealand this species grows in the tussocks themselves; there is none in the spaces between the tussocks. As an inmate of a tussock the grass consists merely of a straggling stem or two, at the base of which are a few rather insignificant leaves; but in this plantation and elsewhere, where stock (including rabbits) cannot get at it, it forms quite large but rather lax tussocks with abundant leaves. So, too, does the plume-grass (*Dichelachne crinita*), also frequent in this plantation, which usually grows in the tussocks, but here has a tussock-form similar to that of the blue-grass. It looks, indeed, as if in the presence of stock neither of these species get a chance to develop, and that the plants in the tussocks are merely survivors in a haven of refuge.

A most interesting point is that in this plantation there are many seedlings of the blue-grass and that these seedlings show many individual differences. I have never noted an adult specimen of blue-grass persisting in a depleted area, but only young plants growing on scabweed mats or cushions. It is certain that many of the specimens in this plantation have originated from seed, and this may apply

generally to other enclosed areas where there is more or less of this grass.

- (2.) *Ground near the new Tarras Homestead which had been ploughed but nothing further done to it.*

There was no opportunity to make a close examination of this area. The following is a list of the species, in alphabetical order: *Agropyron scabrum* (blue-grass), *Crepis capillaris* (hawksbeard), *Dactylis glomerata* (cocksfoot), *Danthonia Buchanani* (Otago danthonia), *Dichelachne crinita* (plume-grass), *Festuca novae-zelandiae* (fescue-tussock), *Hypochaeris radicata* (catsear), *Poa intermedia* (tall blue-tussock), *Poa pratensis* (meadow-grass), *Trifolium dubium* (suckling-clover), *Trifolium pratense* (red clover), and *Triodia Thomsoni* (Otago triodia). Hawksbeard and suckling-clover grew on the stoniest part of the ground.

- (3.) *Piece of Originally Depleted Hillside near Mr. Mackay's House, Tarras.*

On this piece of land there are areas representing three stages—namely, one unfenced and frequented by many rabbits, one fenced from rabbits for nearly two years, and one continuous with the garden and fenced in for nearly five years.

Stage 1: This is continuous with stage 2. Such vegetation as exists is cropped most closely by rabbits; indeed, apparently it contained hardly any available feed. The principal species were sorrel (*Rumex Acetosella*) and annual fescue (*Festuca myuros*)—dry and dead at the time of examination. Other species present are cited below.

Stage 2: In general aspect this area differs *in toto* from that of the adjacent rabbit-infested area (stage 1). There is still much bare ground. The following is an incomplete list of the species: *Aira caryophyllea* (hair-grass), *Anagallis arvensis* (pimpernel), *Carex resectans* (desert-sedge), *Centaureium umbellatum* (centaury), *Cheilanthes Sieberi* (common lip-fern), *Crepis capillaris* (hawksbeard), *Convolvulus erubescens* (trailing bindweed), *Festuca myuros* (annual fescue), *Geranium sessiliflorum* var. *glabrum* (short-flowered cranesbill), *Holcus lanatus* (Yorkshire fog), *Hypericum gramineum* (erect St. John's wort), *Oxalis corniculata* (yellow oxalis), *Raoulia australis* (common raoulia), *Raoulia Beauverdii* (Otago raoulia), *Rumex Acetosella* (sorrel), *Triodia Thomsoni* (Otago triodia), *Wahlenbergia albomarginata* (New Zealand bluebell). The greater number of these species are also to be found on the denuded ground, but in much worse condition and with far fewer individuals. On the other hand, the palatable species, Yorkshire fog and hawksbeard, have gained a footing.

Stage 3: This, the oldest portion, continuous with the garden, contained plants in abundance. The following is an incomplete list: *Agropyron scabrum* (blue-grass), *Carmichaelia Petriei* (thick-stemmed broom), *Centaureium umbellatum* (centaury), *Crepis capillaris* (hawksbeard), *Dichelachne crinita* (plume-grass), *Festuca novae-zelandiae* (fescue-tussock), *Holcus lanatus* (Yorkshire fog), *Hordeum murinum* (barley-grass), *Hypochaeris radicata* (catsear), *Poa intermedia* (tall blue-tussock), *Sonchus oleraceus* (sow-thistle), *Trifolium arvense* (haresfoot trefoil), *Trifolium pratense* (red clover). This list is extremely instructive, for almost all its species are more or less palatable.

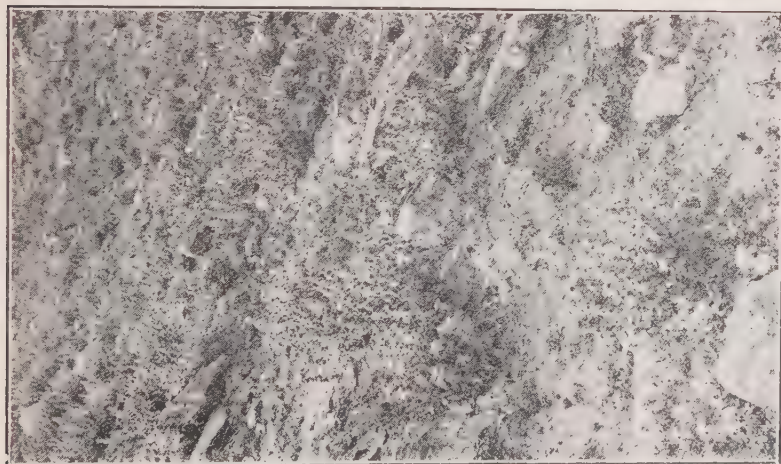


FIG. 1. DEPLETED HILLSIDE GROUND IN DUNSTAN GORGE, OUTSIDE ORCHARD MENTIONED ON PAGE 86.

The large plants are horehound.

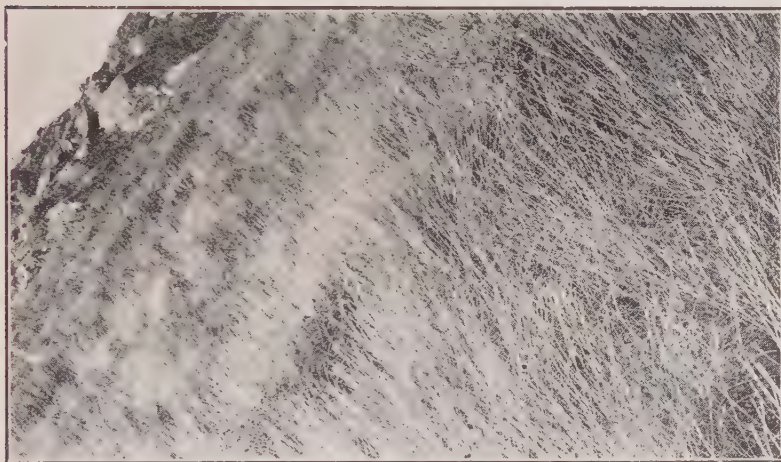


FIG. 2. REGENERATED GRASSLAND IN ORCHARD ENCLOSURE DESCRIBED ON PAGE 86.

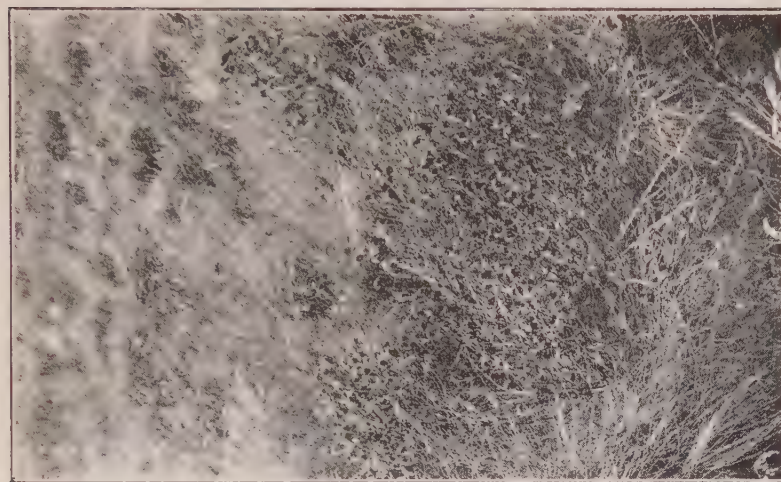


FIG. 3. ANOTHER VIEW OF SAME REGENERATED AREA.

Note the red clover in foreground.

[Photos, T. L. Wright]

(4.) *A Steep Depleted Hillside in the Dunstan Gorge.*

This is a specially interesting example of regeneration, since it has taken place in a situation similar to so much of Central Otago where neither cultivation nor irrigation is feasible. A piece of ground was fenced from rabbits, perhaps about ten years ago, for the purpose of planting an orchard on the fenced-in land. The steep ground near the fence, separating the upper portion of the area from the barren hillside, has not been made use of, and the vegetation now occupying it has come spontaneously without watering or cultivation. This ground has a southerly aspect, but is exposed to the violent north-west wind.

Vegetation of hillside outside the fence: This is well shown in the photograph (Fig. 1). The plant-covering on the depleted hillside is denser than is usual for such an area, owing to the abundance of horehound (*Marrumbium vulgare*)—a plant of extremely low palatability—and to the southerly aspect of the slope, but its value as pasture is trifling. The following is a list of species: *Anagallis arvensis* (pimpernel); *Carduus pycnocephalus* (winged thistle); *Gilia squarrosa* (Californian stinkweed); *Marrumbium vulgare* (horehound); *Oxalis corniculata* (yellow oxalis); *Poa Colensoi* (blue-tussock)*—a tuft or two eaten to the ground, most likely by rabbits; *Raoulia lutescens* (scabweed); *Sonchus arvensis* (sow-thistle)—only a little, and greatly eaten; *Stellaria gracilentia* (mountain-chickweed); *Triodia Thomsoni* (Otago triodia)—a few plants eaten to the ground; *Wahlenbergia gracilis* (slender blue-bell).

Vegetation of hillside inside the fence: There was an extremely dense vegetation about 18 in. deep, made up principally of grasses (see Figs. 2 and 3). The following is a list of the species: *Agropyron scabrum* (blue-grass); *Carmichaelia compacta* (Clutha broom)—in great quantity in places; *Crepis capillaris* (hawksbeard); *Dactylis glomerata* (cocksfoot); *Discaria toumatou* (wild-irishman); *Dichelachne crinita* (plume-grass); *Hypochaeris radicata* (catsear); *Lolium perenne* (rye-grass); *Marrumbium vulgare* (horehound); *Oxalis corniculata* (yellow oxalis); *Poa intermedia* (tall blue-grass); *Poa pratensis* (meadow-grass); *Rosa rubiginosa* (sweetbrier); *Trifolium pratense* (red clover).

(5.) *The Clyde Cemetery.*

This is situated on the flat ground near Clyde. The chief feature of the vegetation is the number of fine tussocks of blue-grass (*Agropyron scabrum*), some of which measure no less than 2 ft. through. In the shade of the poplar-trees there is more or less cocksfoot. The following is a list of the species noted: *Agropyron scabrum* (blue-grass), *Aira caryophyllea* (hair-grass), *Bromus sterilis* (barren brome-grass), *Crepis capillaris* (hawksbeard), *Cytisus scoparius* (broom), *Dactylis glomerata* (cocksfoot), *Hordeum murinum* (barley-grass), *Linum marginale* (Australian flax), *Poa intermedia* (tall blue-grass), *Poa pratensis* (meadow-grass), *Rosa rubiginosa* (sweetbrier), *Rumex Acetosella* (sorrel), *Verbascum Blattaria* (smooth-leaved mullein).

This case is perhaps not one of regeneration, but merely of persistence of tussock, &c., when the causes of depletion are removed.

* This may be *Poa intermedia* (tall blue-tussock).

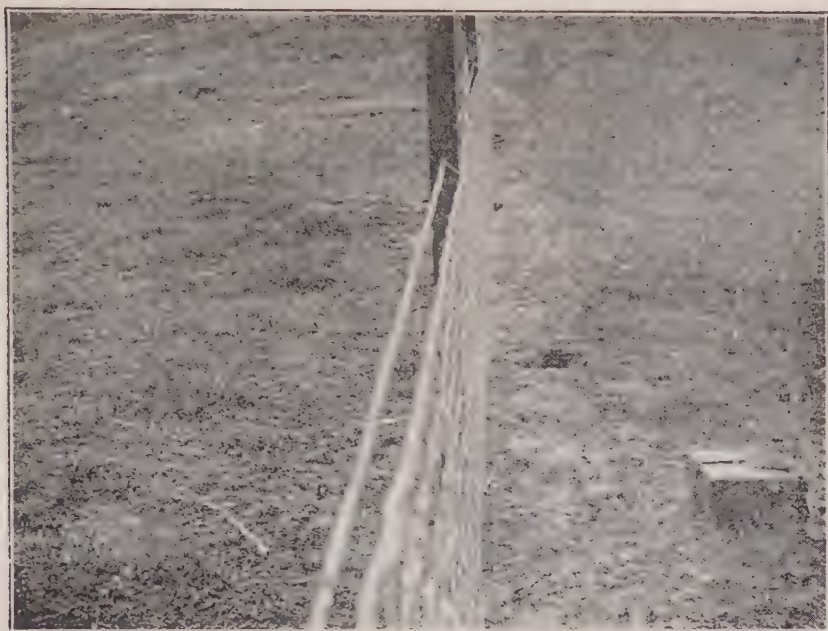


FIG. 4. VIEW OF INTERIOR (LEFT OF FENCE) AND EXTERIOR OF EARNSCLEUGH EXPERIMENTAL AREA IN 1911.

Darker colour of interior caused by growth of sorrel which came about shortly after area was enclosed.



FIG. 5. RECENT VIEW IN EARNSCLEUGH EXPERIMENTAL AREA. FACING SOUTH.

This was absolutely depleted ground in 1911, but now, as shown, is occupied by a natural growth of blue-grass and tall blue-tussock.

[Photos, L. Coekayne.]

(6.) *The Agriculture Department's Earnscliffe Experiment Area near Clyde.*

This was an area of depleted hillside which was fenced from rabbits by the Department of Agriculture in 1910. Of late years, however, rabbits have infested the area to some extent, so that the regeneration has occurred in the presence of more or less of these animals. Also, about two years ago a fire swept through part of the area, destroying many of the tussocks. The ground is 20 acres in extent. The lowest part, which is not generally steep, was ploughed or scarified, seed-beds prepared, and a considerable number of species of grasses and other plants sown. Regarding the behaviour of these nothing will be said here. The only interesting portion of the area from the standpoint of this article is the extremely steep slope. Even there in some places it looks as if certain grasses had been sown, but this may not have been so, and certainly the regeneration of the tussock and many other species has been spontaneous. As it will be necessary to make a thorough examination of the whole area before commencing certain experiments with regard to palatability which are to be conducted thereon, no complete list of the species is given, nor is anything said regarding the cultivated portion.

Where the ground has a southerly aspect, especially at the upper part of the area, there is a dense growth of tussocks of blue-grass (*Agropyron scabrum*) and tall blue-tussock (*Poa intermedia*) (see Fig. 5). The following palatable introduced plants are also present to some extent: Yorkshire fog (*Holcus lanatus*); meadow-grass (*Poa pratensis*); sow-thistle (*Sonchus arvensis*); lucerne (*Medicago sativa*), but only one plant noted; rye-grass (*Lolium perenne*); and, in places, cocksfoot (*Dactylis glomerata*).

Where the ground has a more or less northerly aspect tussock has come in quite sparingly, but there are many introduced species, and in places the ground is well covered. For instance, catsear (*Hypochaeris radicata*) forms almost mats over many square yards—its rosettes of leaves are so close together; in many places there are tussocks of cocksfoot, and in other places large patches of Yorkshire fog. Occasionally there is a plant of tall oat-grass (*Arrhenatherum elatius*). Without going into further details, the total number of species which have settled on the originally depleted steep ground is forty-two, of which no less than twenty-four may be considered more or less palatable. And it must not be forgotten that this has happened in the presence at times of a considerable number of rabbits; but the better food of the cultivated portion below would supply most of their feed.

(7.) *The Experimental Tree-planting Area at Omarama.*

In 1914 a number of trees of various kinds were planted near Omarama under the direction of Mr. R. G. Robinson (then Superintending Nurseryman for the South Island) and the area planted enclosed by a rabbit-proof fence. The ground is quite flat and the soil fairly good.

At the present time there are wide breadths of tussocks of tall blue-tussock and blue-grass (see Fig. 6). There is a little fescue-tussock (*Festuca novae-zelandiae*). In some parts sorrel is the chief plant. Some of the fescue-tussocks measured 16 in. in height, and the tall blue-tussocks 14 in. There was a little red clover (*Trifolium pratense*), some



FIG. 6. IN THE OMARAMA EXPERIMENTAL TREE-PLANTING AREA.

Showing close growth of tussocks of blue-grass and tall blue-tussock which has come in five years.



FIG. 7. BOUNDARY OF OMARAMA EXPERIMENTAL TREE-PLANTING AREA.

Showing regeneration inside fence (on left), and depleted ground, with scabweed, outside.

[®] [Photos, W. D. Reid.]

catsear, and some Yorkshire fog. The total number of species noted was sixteen, but this is probably too low. The contrast between the regenerating grassland inside the enclosure and the depletion outside is clearly marked (see Fig. 7). This case of regeneration is not as striking as some recorded in this article, since on the ground outside exposed to both rabbits and sheep there are still a few tussocks here and there of fescue-tussock.

(8.) *The Experimental Tree-planting Area on the Flat Ground on the Summit of the Sugarloaf, near Lowburn (Central Otago).*

The area under consideration is situated on the flat top of the terrace known as the Sugarloaf, at an altitude of about 1,000 ft. above sea-level. The soil is light, but of fairly good quality. The plantation is extremely narrow, and receives the full effect of both the furious north-west and south-west gales. Outside the area the ground is at almost the maximum stage of depletion; there is little else except the scabweed (*Raoulia lutescens*). Yet within the enclosure (see Fig. 8) there are blue-grass tussocks in abundance, some quite 21 in. high, with a spread of 16 in. Here and there are tussocks of tall blue-tussock; there is a little red clover. Many of the blue-grass tussocks have originated on the scabweed cushions (see Fig. 9).

The following is a list of the other species noted: Catsear (*Hypochaeris radicata*), horehound (*Marrubium vulgare*), annual fescue (*Festuca bromoides*), winged thistle (*Carduus pycnocephalus*), hawksbeard (*Crepis capillaris*), plume-grass (*Dichelachne crinita*), Scotch thistle (*Carduus lanceolatus*), barley-grass (*Hordeum murinum*), and Otago raoulia (*Raoulia Beauverdi*).

(9.) *The Cromwell Racecourse Reserve and the Adjacent Uncultivated Land of the Cromwell Development Company.*

The racecourse reserve: This is a specially interesting example of regeneration, since it affords a comparison to be made between rabbit-infested ground, ground where rabbits are virtually absent but under partial grazing-conditions, and ground side by side with the latter but which is not grazed. The reserve is surrounded by a rabbit-proof fence; it is grazed to its full capacity by sheep, together with some cattle and horses, and about 12 acres of the grazed area are irrigated. At the present time on the flat part of the reserve blue-grass tussocks are dotted about, and there is a good deal of rye-grass. There is some catsear, some hemlock storks-bill (*Erodium cicutarium*)—a palatable herb—and a number of indigenous unpalatable species. On the steep slope facing south-west is abundance of blue-grass tussocks, sometimes more or less eaten, probably by horses or cattle. They are evidently able to have originated under such conditions and to hold their own. How far they would do so were better feed not usually available is another matter. There is also some tall blue-tussock, rye-grass, sorrel, tufted danthonia (*Danthonia semiannularis* var.), and smooth-leaved mullein (*Verbascum Blattaria*), together with eight species or more of unpalatable plants.

The Cromwell Development Company's land: This refers to the steep ground unsuitable for fruitgrowing. It has been kept free from rabbits and stock for five or six years. About two years ago the grass-



FIG. 8. REGENERATION IN THE EXPERIMENTAL TREE-PLANTING AREA ON THE SUGARLOAF, LOWBURN FERRY.

The tussocks are blue-grass, the trees Monterey pine (*Pinus radiata*, syn. *insignis*).



FIG. 9. BLUE-GRASS TUSOCK GROWING ON SCABWEED IN SUGARLOAF TREE-PLANTING AREA.

[Photos, W. D. Reid.]

land about to be described was burnt accidentally at what is universally considered the wrong season. The chief difference between the ungrazed and the grazed area adjacent is that the tussocks on the former are closer together and larger, while certain palatable species are much more in evidence. On a slope facing south-east the tussocks stand at about 3 ft. apart. Tall blue-tussock is the most abundant, but there is a good deal of blue-grass tussock. Rye-grass is plentiful; there is both white and red clover; between the tussocks the ground is closely covered with catsear, or, in places, with hawksbeard, so that there is little bare ground (see Fig. 10). The tussocks and the red clover are frequently more than 20 in. high. There is a little fescue-tussock. On gravelly ground there are no tussocks, but only sorrel, horehound, some scabweed mats, and a little hawksbeard. On a slope facing north to north-west in its upper, steepest part, tussock has not regenerated. There is only sorrel, pimpernel (*Anagallis arvensis*), sow-thistle (*Sonchus arvensis*), catsear, toothed medick (*Medicago denticulata*), and *Vittadinia australis*, a daisy-like plant as yet without a popular name. As the slope gets less steep the species mentioned continue, but they are reinforced by some blue-grass, and where the slope is still more gentle this grass increases in quantity, white clover appears, and there is more catsear and hawksbeard (see Fig. 11). There is also annual fescue in abundance.

CONCLUSIONS.

1. Regeneration of a depleted area may, if the conditions are favourable, come about through the complete exclusion of rabbits and stock.

2. Even in the presence of a limited quantity of stock, and even rabbits, regeneration may take place.

3. If rabbits alone be excluded, blue-grass (*Agropyron scabrum*) and tall blue-tussock (*Poa intermedia*) can hold their own in the presence of sheep, cattle, and horses so long as there is a fair amount of other feed present.

4. Blue-grass and tall blue-tussock are early arrivals, and both increase rapidly by means of seeds.

5. Blue-grass assumes the tussock-form—a growth-form altogether different from that of this plant when growing within the shelter of a fescue-tussock or a poa-tussock.

6. The plume-grass (*Dichelachne crinita*) behaves in all particulars regarding its growth-form like the blue-grass, but it is far more uncommon, and cannot spread so rapidly.

7. Many other plants may gain a footing in enclosed ground and spread rapidly, especially sorrel, catsear, hawksbeard, Yorkshire fog, barley-grass, and annual fescue.

8. Even one year's exclusion of rabbits and sheep leads to a considerable increase in the amount of vegetation, sorrel being usually the first palatable plant to appear in quantity.

9. Cocksfoot can naturally increase in an area shut up from stock and rabbits, and can become established under drier conditions than tussocks of indigenous grasses.

10. Red clover (at times) and white clover (frequently) occur as plants of regenerating pasture.



FIG. 10. REGENERATED AREA ON CROMWELL DEVELOPMENT COMPANY'S LAND.

Totally depleted at time of erection of rabbit-fence six years ago; now covered with dense growth of tall blue-tussock, blue-grass, and other plants.



FIG. 11. PART OF SAME AREA AS IN FIG. 8, BUT ON FLATTISH GROUND FULLY EXPOSED TO THE SUN.

Note the comparatively few tussocks, and the white clover in foreground.

(Photos W. D. Reid.)

11. The nature of the ground and its aspect makes a great difference to its chance of regeneration. Thus shady* slopes are favourable for indigenous grasses, and sunny slopes unfavourable; so, too, is gravelly ground hostile to such settlement.

12. Extreme wind does not debar pasture from regenerating.

13. A considerable proportion of the regenerated pasture is palatable.

14. Most likely a good deal of regeneration arises from seeds being blown on to the enclosed area, though in many cases it arises from plants already on the ground.

15. The fescue-tussock—the dominant tussock of montane tussock-grassland—only appears in small quantity and spreads very slowly.

16. Except the New Zealand grasses already cited, hardly any others take a part in regeneration.

17. The New Zealand brooms—species of *Carmichaelia*—readily become abundant in areas free from rabbits, but in the first instance the plants arise from bushes which have been cropped to the ground.

18. The scabweed (*Raoulia lutescens*) and other species of that genus offer in their mats or cushions excellent seed-beds, and are a potent factor in regeneration. (This matter will be dealt with in a special article).

ROTATION OF CROPS.

A SYSTEM FOR DAIRY FARMS.

J. L. BRUCE, Superintendent of Experimental Farms.

In the growing of more animal-feed, together with the keeping of a better class of stock, lies the main key to increased primary production in New Zealand, involving also closer settlement and better farming.

There is much land in this country admirably suited for a sound system of rotation farming, and upon which production could be easily doubled. The accompanying table shows a six-course rotation suitable for some of the dairying districts in the North Island. This system of rotation has been commenced at the Central Development Farm, Wera-roa, on a fairly extensive scale, and is also to be commenced on a smaller scale at the Ruakura Farm of Instruction and Moutahaki Experimental Farm, with slight variation to meet soil conditions and local requirements. On each of these farms those interested will in due course have an opportunity of seeing the system in practice.

It is not recommended that the whole area of any farm should be put under any rotation system. It is considered that from half to two-thirds of the total area of arable land will be best suited to meet requirements, the remainder of the holding being reserved for, say, a permanent lucerne stand, pig-paddocks, and a small area of maize for emergency purposes, &c. Maize, being of rapid growth and giving a heavy yield per acre, is considered a safe crop in case of early drought,

SIX-COURSE ROTATION FOR DAIRY FARMS.

Paddock No. 1 (12).	Paddock No. 2 (28).	Paddock No. 3 (10).	Paddock No. 4 (14).	Paddock No. 5 (16).	Paddock No. 6 (11).
1920. Grass. Plough in autumn for roots to follow.	1920. Roots. Plough in spring and sow in peas, barley, &c.	1920. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares	1920. Oats and Tares for Hay. Plough in autumn and sow out in grass.	1920. Grass. (Clover hay.)	1920. Grass.
1920-21. Roots. Plough in spring and sow in peas, barley, &c.	1920-21. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares.	1920-21. Oats and Tares for Hay. Plough in autumn and sow out in grass.	1920-21. Grass. (Clover hay.)	1920-21. Grass.	1920-21. Grass. Plough in autumn for roots to follow.
1921-22. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares.	1921-22. Oats and Tares for Hay. Plough in autumn and sow out in grass.	1921-22. Grass. (Clover hay.)	1921-22. Grass.	1921-22. Grass. Plough in autumn for roots to follow.	1921-22. Roots. Plough in spring and sow in peas, barley, &c.
1922-23. Oats and Tares for Hay. Plough in autumn and sow out in grass.	1922-23. Grass. (Clover hay.)	1922-23. Grass.	1922-23. Grass. Plough in autumn for roots to follow.	1922-23. Roots. Plough in spring and sow in peas, barley, &c.	1922-23. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares.
1923-24. Grass. (Clover hay.)	1923-24. Grass.	1923-24. Grass. Plough in autumn for roots to follow.	1923-24. Roots. Plough in spring and sow in peas, barley, &c.	1923-24. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares.	1923-24. Oats and Tares for Hay. Plough in autumn and sow out in grass.
1924-25. Grass.	1924-25. Grass. Plough in autumn for roots to follow.	1924-25. Roots. Plough in spring and sow in peas, barley, &c.	1924-25. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares.	1924-25. Oats and Tares for Hay. Plough in autumn and sow out in grass.	1924-25. Grass. (Clover hay.)

NOTE.—The actual paddock numbers at the Central Development Farm are shown in parentheses after the other numbers.

when it can be cut green for feed, thus saving both the fodder-hay and clover-hay crops for winter.

The tabulation of the Weraroa rotation system may be more easily followed and the benefits better understood by indicating its practical application on, say, a 50-acre holding, which acreage, as time goes on, will in all probability become quite an average-sized farm in the best dairying districts of this country, more especially in the North Island. Of the 50 acres, 30 acres—in six paddocks of 5 acres each—would be under a regular six-course rotation similar to the Weraroa scheme. Under favourable conditions the yields would probably be as stated in the following remarks:—Paddock 1: Two hundred to three hundred tons of roots. Paddock 2: One acre each of peas, barley, beans, and linseed, yielding, say, 30 to 40 bushels per acre, with 1 acre of potatoes. Rape is not essential in the rotation system on a small holding. These crops will ensure abundance of home-grown calf-feed, and also sufficient for finishing off pigs reared under the depasturing system, which will be dealt with in a subsequent article. On most small dairy farms worked on the rotation system a few good Romney ewes will be found very profitable and useful for cleaning-up purposes. Paddock 3: The oats and tares may be expected to yield from 15 to 20 tons of fodder hay. Paddock 4: First and second cut, possibly yielding 15 tons of hay. If the season is favourable the second crop may be allowed to seed, from which, at present prices for red clover, a handsome return may be obtained, and still leave the hay for stock-feeding purposes. Although the rotation system now advocated is by no means exhausting on the land if practised under good farming principles, it is recommended that in the late autumn, after the second crop of hay has been removed, the paddock should be top-dressed with a light dressing of manure, given a double harrowing with the tripod harrows, and closed up until the spring. Paddocks 5 and 6 are in pasture.

It may be observed that while the main object of this system is the increased production of dairy-produce, with ample provision for winter feed, which is so essential for profitable dairy-farming, some of the crops, particularly oats, vetches, and peas, are excellent smothering-crops for the eradication of weeds, which have become a serious scourge on much of the best arable land in dairying districts.

After providing for a homestead area, a lucerne stand (where the land is suitable), pig-paddocks, &c., already referred to, the remaining 20 acres will be required for pasture, which, if permanent, should be tripod-harrowed every autumn, with an occasional dressing with basic slag, or, if not available, bonedust or superphosphate, or both, according to the requirements of the soil.

It may be argued that rotation farming as here advocated is all very well in theory or for the Government to practise upon its farms, but that labour is unprocurable, and the small farmer cannot afford to employ assistance or keep horses for tillage. It will be observed, however, that of the six paddocks three are in grass, which means that on a 50-acre holding only about 15 acres are under cultivation at one time, and as practically every dairy-farmer has to keep one spring-cart horse it only involves keeping a second horse. A light two-horse team is ample for the working of a 50-acre dairy farm run on this system, or even a considerably larger area.

MILK-PRODUCTS IN AMERICA AND EUROPE.

A RECENT INVESTIGATION.

W. DEMPSTER, Dairy Division.

ACTING in accordance with departmental instructions, the writer left New Zealand for North America in June last, for the purpose of making inquiries into the manufacture and marketing of milk-powder, sugar of milk, and other branches of dairying as carried on in the United States and Canada. The range of the investigation was subsequently extended to Europe, the United Kingdom and certain parts of the Continent being visited.

Travelling by the same steamer from Wellington to San Francisco were the dairy-industry delegates from Taranaki, also the assistant secretary of the National Dairy Association, Mr. T. C. Brash, all of whom were on a somewhat similar errand to myself. Mr. Brash and I visited together a number of districts in America, where we jointly conferred with those in charge of factories or others who were concerned in matters pertaining to the dairy industry.

TRAVEL AND OBSERVATIONS IN THE UNITED STATES.

Shortly after our arrival at San Francisco we had an opportunity of attending a meeting of the Dairy Council of California, at which many interesting subjects in regard to dairying were discussed. The Council is a body of dairymen somewhat resembling that of our representative dairy associations in New Zealand. One subject dealt with was that of the assistance required on the farms for the milking of dairy herds, a question which appears to have been more acute in America than in New Zealand. Those engaged in the industry in California are more or less sceptical regarding the use of milking-machines, looking upon them as a somewhat doubtful proposition, and the releaser system, with all its attendant dangers from a sanitary point of view, is unknown in that locality. We were here introduced to many of the leading dairymen of the States, which subsequently proved to be helpful to us in prosecuting our inquiries in other parts of the country.

The opportunity was afforded us of visiting the Californian Central Cream Company's large works at Ferndale and Eukera, where we were supplied with full information regarding each product handled. The operations of this concern include the manufacture of skim-milk powder, butter, Swiss cheese, and sugar of milk, and are carried on upon a very extensive scale. The quality of the milk-powder, which is prepared by the Grey-Jensen spray system, is considered to be one of the best in the country, and finds a ready sale at remunerative prices. The bulk of the milk received by the company for drying is delivered to the factory or to skimming-stations by the farmers delivery being twice daily. The skim-milk from the skimming stations is conveyed to the drying-factory in cylindrical tanks attached

to motor-lorries, and is discharged from the tanks by compressed air. The whole milk is carefully tested for purity on the receiving-stages before being accepted for the manufacture of milk-powder. This test immediately indicates whether the milk has been properly cared for or not. An examination of a portion of the milk being received was made by me, and in my opinion the condition was of a high average standard, comparing more than favourably with much of the milk delivered to the factories in New Zealand. The price paid by the company at the time of our visit (autumn) was 2s. 11d. per pound of butterfat, together with an allowance for the skim-milk of 1s. 10½d. per 100 lb. The latter payment applied only to the supplies delivered to the drying-factory; a charge of 3½d. per 100 lb. was made for the carriage of the skim-milk if delivered to the stations only.

The next factory visited was that of the Associated Dairymen of California, at Sacramento, which was nearing completion and expected to commence operations at an early date. The process of drying milk adopted at this factory is also on the spray system, the intention being to concentrate the milk into a heated chamber prior to the spraying. Another large factory at Modesto was also visited. The scope of the association's business at this centre consists in the manufacture of butter, muriatic-acid casein, sugar of milk, and what is known as "jack" cheese from the milk standardized to 1.15 per cent. of butterfat. The milk-sugar plant at this factory was very similar to that used at the New Zealand Sugar of Milk and Casein Company's factory, at Edendale. Here we were freely shown the methods adopted in preparing the sugar of milk and other products.

At Modesto arrangements were made for us to see over the large milk-condensing establishment belonging to Bordens Ltd., which is situated close to this centre. The quantity of milk handled is 12,000 gallons per day. Both sweetened and unsweetened milk is prepared, and packed in 1 lb. and ½ lb. tins. Most of the output is sold in America, although efforts are being made to extend the export trade.

At Omaha we found that an important feature of the dairy industry was the manufacture of butter. So far as the methods adopted are concerned, we did not consider that these were in advance of the ordinary practice in New Zealand. It was noticed, however, that the buttermilk was dried and sold in powder form, two systems of drying being in vogue, one factory using the spray method and two others having heated-roller plants for this purpose. The powder prepared by the spray system was realizing 10d. per pound, and that made by means of the rollers 7d. to 7½d. per pound. In the former case buttermilk was being received from outside districts, where it had been condensed to 25 per cent. of its original volume, thus reducing the cost of transport and also curtailing the drying process at the central factory. In one instance we were struck with the economical use which was made of practically the whole of the heating-surface of the rollers. One large roller, about 4 ft. in diameter, was heated by steam and the milk distributed on its surface by means of a small roller, 10 in. in diameter, which was running in the body of the milk to be dried and in contact with the roller of larger size. The film of milk is in this way transferred to the heating-roller at a point almost immediately below that at which the dried film of milk leaves the heated surface.

At one of the butter-factories at Omaha we saw the operation of mixing milk-powder, butter, and water into a liquid representing a cream containing 25 per cent. of butterfat. The desired quantity of water is added to a jacketed vat, then the right proportion of skim-milk powder and butter is added, the butter having been previously tested for moisture-content. The vat is fitted with an appliance which resembles a ship's propeller on a small scale, and is revolved by mechanical power. The motion is regulated at a high speed until the powder is thoroughly incorporated with the water. The speed is then reduced, at which time the butter is added, and the temperature of the contents of the vat gradually raised to 145° F. It is held at this temperature for twenty to thirty minutes and then cooled to 135°, after which it is put through the homogenizer and immediately cooled to 45°.

Later we saw what is considered an improved method of reconstituting milk. The powder and water are mixed as previously described. The butter is first of all heated to a temperature of 120° and forced into the mixture of water and milk-powder by means of a special pump fitted with a spray nozzle. This spray of melted butter is introduced under the surface of the liquid, and is thereby evenly distributed throughout the mixture of water and powder.

I do not regard the reconstituting of milk as an important factor in the skim-milk-powder industry. Were the milk separated, the cream made into the finest butter, and the skim-milk made into the finest powder, then reconstituted the same day, I would not consider this reconstituted milk as good as the original milk. I have seen samples of reconstituted milk (not made for commercial purposes), very nice and sweet, and soured with a clean lactic-acid flavour, but this milk was made under conditions which could never be attained in daily practice. There is no known method of reconstituting milk whereby the cream can be made to rise as in ordinary fresh milk. It is, however, a simple matter to reconstitute milk to make it show the same analysis as new milk, and no difference can be detected until it is tasted. The object of reconstituting milk would be to tide over a period of shortage in the supply of fresh milk in towns. Where this has been tried the housewife has complained if more than 10 per cent. of the reconstituted milk has been added to the fresh milk. Again, the irregularities in flavour of the best-keeping butter after storage, combined with the irregularities in milk-powder, are such that an even-flavoured milk could not be maintained from day to day.

Our next call was at Minneapolis, where we met Dr. S. M. Dick, who has been instrumental in starting a company to manufacture dried milk, and has patented a process in the treatment. This consists in spraying the milk into two separate air-heated chambers. In the first one the milk is only partially dried, and the process is completed in the second chamber.

After visiting Madison and meeting Professors Woll, Sammis, and Weigel, by whom we were well received, we proceeded to Meston, at which place there is a large milk-drying factory. The works were being enlarged and certain improvements made whereby a larger quantity of milk can be handled. New heating-chambers have been introduced, which provide for the treatment of 9,000 gallons per day of twenty-four hours in each chamber. The walls have a thickness of 18 in.,

are thoroughly insulated, and are finished with an asbestos plaster on the inside. Only skim-milk is dried here, and it was ascertained that the yield of powder was 8.9 lb. per 100 lb. of milk dealt with, it being stated that 0.1 per cent. was lost in the process of evaporation. The point was stressed that milk for drying purposes should not contain more than 0.2 per cent. of acidity.

At Waukeshaw, where milk-condensing is carried on extensively, I was able to see over the factory, at which 14,000 gallons of milk were being received daily. A large portion of the finished product is exported. The coal-consumption at these works was stated to be 14 tons per day, some 140,000 gallons of water being also required daily. The milk is pasteurized, and held at a temperature of 140° in metal enamelled tanks while awaiting condensation. Tanks of this nature may be found an advantage in connection with our industry in New Zealand, and, in my opinion, would make excellent whey-tanks where this liquid is separated for buttermaking. The tanks are manufactured by the Eeyria Enamelware Company, Ohio.

We arrived at Chicago at the end of July, and here we got in touch with several large firms which are connected with the milk-powder industry. While a considerable amount of information concerning the drying of milk was obtained, it was noticed that the method of treatment did not differ to any great extent from the practice at other factories visited. The opportunity was also taken while in Chicago to interview Arthur Harris and Co. and the Swenson Evaporating Company, both of whom are makers of vacuum-pans, condensing machinery, and other dairy appliances, particulars of which were noted for reference if required at a future date. The well-known firm of Swifts was also interviewed, and I was informed that this company controlled about 60 per cent. of the creamery butter produced in the country.

While visiting the stockyards at Chicago the marketing of veal calves came under my notice. Calves ranging from four to five weeks old were disposed of for slaughtering at from £3 10s. to £5, the weight being from 85 lb. to 110 lb. The same thing was seen at the cattle-yards in New York, where the prices were running from £3 to £4 12s. per head. I was informed that these calves were collected at the pig-receiving depots throughout the country and forwarded to the abattoirs. In view of these prices for veal and the fact that this meat was being sold in London and Glasgow at the time of my visit at 11½d. per pound, it would seem that some effort should be made to market the calves which are destroyed annually in New Zealand in such large numbers.

Alma and Detroit were then visited. At Alma I saw a special continuous condenser which has proved very successful in connection with the drying of milk. Condensers of this type are on the market for sale by the makers. The factory of the Detroit Creamery Company was visited, where a very large business in buttermaking is carried on. The company also manufactures some 5,000 gallons of ice-cream daily. A portion of the cream is frozen during the summer months in order to keep the ice-cream trade going at the time of scarcity during the off season.

My inquiries in regard to casein took me to Philadelphia, which is the headquarters of the Union Casein Company. This concern has a very large controlling interest in the marketing of casein, and was holding a stock of between 3,000,000 lb. and 4,000,000 lb. A shipment

of 100,000 lb. was just being made to Denmark at the price of 6½d. per pound f.o.b. I was told that a patent had been taken out for the preparation from casein of a paint made which will stand water and also remain fast in colour, and which may be put up for sale in any colour desired.

After spending several days in New York, during which time many of the firms interested in the marketing of dairy-produce were interviewed, I proceeded to Syracuse, which is the headquarters of the Merrell-Soule Company. This company is paying 12s. 6d. per 100 lb. for milk containing 3 per cent. of butterfat, and an additional 2d. for each tenth of a pound of butterfat above 3 per cent. The yield of milk-powder obtained by this concern is from 8.4 per cent. to 9 per cent.

Before leaving the United States for Canada a further number of milk-powder factories were visited.

INVESTIGATIONS IN CANADA.

With the exception of five factories owned by Canadian Milk Products, Ltd., whose head office is at Toronto, there has been no development of the milk-powder industry in Canada. The Canadian Milk Products seems to be a prosperous concern. The business is conducted with characteristic Canadian thoroughness, and on highly scientific principles. A bacteriologist is employed, and frequent tests are made at every stage in the process of manufacture. As showing the demand this company has for milk-powder, it may be stated that an order for an additional supply of 200 tons per month had to be refused. The system used is the Merrell-Soule spray method. The output of the company is skim-milk powder and butter only, and is a very large one. A portion is exported to Great Britain, and the remainder is sold in Canada or America.

Notwithstanding the enormous production of milk in the eastern provinces of Canada, it is rather significant that so comparatively little attention has yet been paid to the manufacture of milk-powder, for it must be conceded that the Canadians are by no means slow to take advantage of any change in the dairy industry which will bring in a higher return to themselves individually or prove more remunerative to the country in general. From inquiries made of the leading authorities on dairying, including Mr. J. A. Ruddick, Dairy and Cool Storage Commissioner of the Dominion, I gathered that in Canada the drying of milk is not looked upon as likely to supersede the ordinary uses of milk for the manufacture of cheese and butter. The opinions expressed to me in this connection indicate clearly that there is need for caution where a change from the present lines of dairying is contemplated. The danger of overproduction of milk-powder must not be overlooked, and those engaged in the dairy industry in Canada are by no means carried away by the high prices paid for milk for this purpose in the United States or any other country.

The production of milk-sugar has not yet been taken up in Canada, nor is it likely to be while the present state of the market for that product exists.

INQUIRIES MADE IN BRITAIN.

I left Canada for England in the middle of September. On arrival in London I began an investigation into the prospects of marketing milk-powder from New Zealand. At the outset I found that a number

of well-known importers of our dairy-produce were already devoting their attention to this matter, in anticipation of supplies of skim-milk powder reaching the London market from the Dominion in the near future. Several of these merchants informed me that they had arranged for one of their representatives to specially inquire into this particular trade, so as to be in readiness to place any consignments that may be received.

As will be seen in a later part of this report, large quantities of milk-powder are already marketed in Britain. In my interviews with both merchants and others who are in touch with the market all spoke hopefully of the prospects for the sale of skim-milk powder in England and Scotland, providing the supplies do not come forward in too great a volume or before the users, who are steadily increasing in number, find that this product is one which can be successfully handled in large quantities.

As regards the preparation of milk-powder in England there has been no material development, neither is there expected to be, on account of the demand for fresh milk for consumption in the towns and the prices ruling for cheese, butter, and other dairy-produce. The drying of milk has, however, been going on for some time at Wrenbury, near Crew. I called at this factory, which is owned by Tru Foods, Ltd. The system of drying the milk here is the Merrell-Soule, and exactly the same as that in operation at so many of the milk-powder factories in America. The powder turned out at Wrenbury is of excellent quality, and was being sold at 13½d. per pound at the factory-door during the time of my visit. The sale of all powdered milk imported into England produced by the Merrell-Soule method of drying is controlled by Tru Foods, Ltd.

Beyond a certain amount of experimenting the drying of milk has not been undertaken in Scotland. It is, however, carried on to some extent in Ireland.

VISIT TO HOLLAND.

Being aware that the milk-powder industry had been established in Holland some years ago, I decided to visit that country, and did so in company with the dairy-industry delegates from Taranaki, who were then in London. For reasons which need not be mentioned here the trip to Holland was, however, a hurried one. At The Hague we met the Minister of Agriculture, the director of the Butter Control Station, and other officials. We were given every opportunity of following up our mission, and were supplied with many particulars regarding the dairy industry in Holland, mention of which is made later on.

FACTORS IN THE PRODUCTION AND MARKETING OF MILK-POWDER.

The total production of milk-powder in the United States in 1918 was 25,626,000 lb. Of the total milk-powder produced, about 25 per cent. was from whole milk. The amount consumed in the States is estimated at 18,000,000 lb., or only 0.16 lb. per head of the population. Besides the quantity stated, peptonized, humanized, and sterilized milk-powders are manufactured, but I could get no figures showing the amount.

The United Kingdom imported, in 1918, 9,977,408 lb. of milk-powder, and manufactured 1,121,790 lb., making a total of 11,099,198 lb. con-

sumed in the country—equal to 0.27 lb. per head. The principal exporting countries were the United States, 61,210 cwt.; Netherlands, 20,105 cwt.; Canada, 5,908 cwt.; Victoria, 602 cwt.; other British possessions, 1,259 cwt. Sweden, Denmark, Germany, France, and other foreign countries, which exported a total of 11,562 cwt. in 1914, had not sent any into England since that year. In addition to milk-powder the United Kingdom imported 5,600,000 lb. of dried milk under the heading of "impoverished, humanized, peptonized, and sterilized milk." This milk is principally invalids' and infants' food, and works out at 0.14 lb. per head. New Zealand, with 38,335 cwt. (Glaxo), heads the list, the United States (6,205 cwt.), Australia (3,832 cwt.), and foreign countries (581 cwt.) being the other exporters. The total milk-powder imported, including the infants' and invalids' product, works out at 0.41 lb. per head, which, when compared with either butter or cheese consumption, is very small. Neither in England nor America did I find any wholesale stock of milk-powder, this indicating that available supplies were in the hands of the actual users.

I saw milk being dried on eight different makes of rollers, and under eight different systems of spraying. I do not think that the owner of any system would claim that it was perfection under all the different existing conditions. The quality of the raw milk causes about as much variation in the quality of powder as do the different systems of drying. It has to be borne in mind that a fault in the milk, either in overacidity or in flavour, is greatly multiplied in the finished powder. The milk-powder business, at both the manufacturing and marketing ends, is in more or less an experimental stage. Were it possible for all manufacturers to have the milk dried and packed into tins two hours after milking probably 50 per cent. of the trouble now arising would be obviated. I have seen both good and bad samples of skim-milk and whole-milk powder made under the same process, with solubility and flavour so different as to lead one to believe that the process must have differed. The difference in quality was due, however, to the variation in raw material. The processes of cheese and butter manufacture can be varied more than the process of drying milk, consequently the difference in raw material from day to day causes a greater variation in the quality of powder than it does in the quality of either butter or cheese.

The keeping-quality of whole-milk powder, no matter under what process it is manufactured, cannot be regarded as satisfactory. The best whole-milk powder I saw was contained in sealed tins and kept at a temperature corresponding to that at which butter is stored. This increased the cost of production, or handling, but it is too risky to do otherwise. The daily output of any whole-milk-powder factory is not sufficiently uniform to warrant the housewife securing a daily supply at any country store, where the age of the powder may be indefinite. The Merrell-Soule Company, of Syracuse, are the only people I have met who are making experiments with the keeping of whole-milk powder for a definite period in cold storage. They have confined themselves hitherto to fulfilling special orders for whole milk which they knew was not required to keep indefinitely. They are now conducting experiments by storing in barrels and tins. The barrels contain 160 lb., with double paper lining (the linings are strong, almost like thin leather); the tins, containing 50 lb., are square-shaped with round hole in centre,

and the cover is sealed with paraffin. The packages are kept in a dry atmosphere, with a temperature of 0° to 8° below zero F.

Having given due consideration to the different processes of manufacture, and knowing that the principles underlying the manufacture of milk-powder will have to be modified and adjusted to suit our New Zealand conditions, I feel confident that we can and shall evolve our own process. Our butter and cheese industry was started on general principles, and we have evolved what suits our conditions. We shall no doubt do likewise with milk-powder.

Should any factory decide to manufacture milk-powder on the roller system, there are different types of rollers to be bought, just as there are different kinds of separators. The makers of different rollers may be constrained from using certain patents that another roller-manufacturer has protected, but that would affect us no more than the patents which protect one separator-manufacturer from having his separator copied by another. There is no need to pay royalty. The manufacturer of the rollers is only looking for the trade in rollers.

When drying milk with what is known as the spray process the system of manufacture is to condense to a 3 or 4 to 1 consistency, either by vacuum-pan or what is known as a continuous condenser. There are numerous makes of pans and condensers on the market, which can be bought the same as any other dairy machinery. There are different methods of spraying into a chamber. Some use one kind of nozzle and some another, but, as long as a particular nozzle which is covered by patents is not used, any one can spray milk freely. There is in general no more restriction on spraying milk than there is on spraying water. A chamber of any size or shape can be built without restriction, while hot or cold air can be taken in or out as desired. There is no need to pay royalty in the manufacture of milk under any spray process, providing a nozzle which is protected by patent is not used.

That the demand for milk-powder exceeds present production is certain, but how much further production can be increased without exceeding demand is hard to gauge. When the milk-powder industry started in America this phase of the business was considered, and only buildings of a temporary nature were erected. Now that the milk-powder business is more firmly established more permanent buildings are being erected, so that the erection of temporary buildings is not to be recommended. If it came to the survival of the fittest New Zealand would be one of those countries to survive, provided the quality of the powder was equal to that of other countries. There is every reason to believe that our powder should be equal to, if not better than, any produced, as our cows are mostly grass-fed and our pastures good. If we do not succeed it will be because the manufacturer or farmer has failed to carry out the good work which the cows begin. We can produce milk more cheaply than any country, thanks to our climate, rainfall, and the milking-machine. We have less money invested in land and buildings per cow than any country visited. In the western States of America dairying takes £105 to £110 worth of land per cow, the middle west £110 to £120, and the eastern States £120 to £130. In Holland the amount is about £300 per cow. In New Zealand our cows are much lower in money value than in the countries referred to. These facts bear weight when considering the future development

of dairying, as a dairy-farmer can start in New Zealand with less capital than in almost any country supplying the world market.

I could get very little reliable data regarding the cost of manufacture of milk-powder. Most of the manufacturers are proprietary concerns, and the matter of cost touches on private affairs. The cost, however, is somewhere in the vicinity of 3d. to 3½d. per pound of finished powder. I found the cost of manufacture of butter to be much the same, but, if anything, higher than it is in New Zealand. Coal is a very expensive item, and will be one of the deciding factors for a company contemplating the erection of a milk-powder factory, the quantity required for a 3,000-cow factory being between 5 and 6 tons per day. Without a guaranteed coal-supply, or equivalent supply of electric power for heating, it would be useless to contemplate making milk-powder.

To manufacture milk-powder of the finest quality it is necessary to have the milk delivered both morning and evening; therefore two shifts of men are required at the factory.

The minimum number of cows required is 3,000, giving a daily supply of from 9,000 to 10,000 gallons. The necessary buildings would cost approximately £15,000 if erected in concrete, and could be made to cost more. Manager's house and accommodation for eighteen to twenty men would also have to be allowed for. The corresponding plant, which would include separators (but no other buttermaking machinery), would cost from £15,000 to £18,000. To establish condensing-stations to work in conjunction with a central drying-factory would not lessen the cost, as practically all the machinery at a condensing-station would be identical with that at the central factory, if an equal supply were received. The central factory would require to make additional chambers for finishing the powder, so that the only saving might be in the carting of the material to the condensing-station. The fuel required at a condensing-station would be fully four-fifths of that required during the whole process, so that one-fifth of the coal-cartage could be avoided; but in carting the concentrated milk there would be 25 lb. to 30 lb., against 9 lb. of the powder. This difference would more than compensate for the difference in coal and crate cartage, &c. I could not get much information regarding the effect on quality of carting the concentrate, but it is certain that it does not improve it. Therefore at the present juncture the erection of condensing-stations is not to be recommended.

When in Holland I noticed parchment-lined wooden packages containing 100 lb. of powder, which I regarded as a satisfactory container. I saw some of the same packages landed in England, however, and fully 25 per cent. of them were damaged, two packages were entirely empty, while others were partly empty: I also saw square tins containing 56 lb., not crated, so knocked about as to resemble a dump for empty tins. I regard sealed tins, two in a crate, as being the only satisfactory package, especially as our export milk-powder has to go through the tropics. Continuity of supply will be an important factor in creating a demand for milk-powder, and if properly packed in sealed tins the powder can be stored to suit the market.

Whole-milk powder is used principally in the manufacture of chocolate and high-class confectionery, and generally goes straight from the milk-powder factory to fulfil special orders. Skim-milk powder is

also used by confectioners, chocolate-makers, and bakers. Further, it is used largely in the manufacture of margarine. A considerable quantity is also used in the ice-cream business in America. It is estimated by brokers in the trade in England that so far not more than 3 per cent. of the bakers are using skim-milk powder. No old customers are being lost, while new ones are being gained. The demand will be from margarine-manufacturers, bakers, and confectionery-makers. If sufficiently advertised it will also be used in every country where bread is baked.

What the trade requires is a soluble powder with good flavour; if soluble in cold water, so much the better. On 11th November last the London quotations for skim-milk powder were as follows:—Netherlands, 115s.; other brands—soluble in hot water, up to 129s.; soluble in cold water, 150s. Netherlands powder is made on the roller system and is not so soluble; it contains a higher percentage of acidity, and the flavour is not so clean. The position New Zealand milk-powder may occupy on the world's markets depends greatly on the care of the milk on the farm.

As regards the future of milk-powder, while satisfied that the present supply to the British market does not meet the demand, I would recommend our New Zealand dairy companies in suitable localities, before undertaking the manufacture of milk-powder, to watch the effect which the additional 3,000 tons from the Dominion, the manufacture of which has already been arranged for, will have on the market. Such increase from New Zealand (with a further large increase to follow) will, in my opinion, be too much for the British market to absorb in one year. The securing of men skilled in the manufacture of milk-powder is another important point; in fact, so vital that caution is to be recommended even were it certain that no country but New Zealand was contemplating immediate extension of the industry. The statistical and general position of milk and milk-products throughout the world, in its bearing on the milk-powder question, may be discussed in greater detail in a supplementary report.

SUGAR OF MILK.

The production of milk-sugar in America has been carried on for a great many years, and has passed through various periods of successful operation and depression of the trade. Prior to the war the industry was in a somewhat precarious condition, owing to the large accumulation of stocks. Shortly after the war began the demand for milk-sugar from America increased, and this had the effect of enabling the manufacturers to carry on. In 1918 the demand for milk-sugar in England greatly increased, and the importations from America were far in excess of any previous year. I was informed that 10,000,000 lb. of milk-sugar was exported to Great Britain during the war period, and that 85 per cent. of this amount was delivered in 1918, which had the effect of clearing the accumulated stocks in America. It is understood that the greater portion of this sugar of milk was used for making smoke-shells. In normal times the consumption of milk-sugar in Britain varied from 300 to 500 tons per annum, and was used almost solely in the manufacture of foods for infants and invalids.

When travelling through the United States I found that stocks of milk-sugar had again increased, and that the market was greatly congested. On leaving England a somewhat similar state of things existed as regards this product, and a few sales only were being effected.

It is estimated that 90, per cent. of those who started manufacturing milk-sugar in America have suffered a financial loss thereby. One prominent sugar-manufacturer admitted to me that he kept his factory running at a loss for two years, and only made it a success by securing the services of his rival's best man. It is estimated that milk-sugar costs 6d. per pound to manufacture. Considering the capital to be invested and the amount of labour and coal required—six men and 6 tons of coal to 1 ton of sugar daily—it would seem that from an economic point of view we could invest money more profitably and use our coal and employ our labour to better advantage. In Holland during my visit the only milk-sugar factory that had been working continually since before the war was closed because coal could be used more advantageously in other industries. Apart from milk-sugar used for war purposes there is comparatively little market. The factory buildings in the United States are of a very temporary nature, and are now written off; so that were we to go extensively into the sugar-of-milk business we would be paying interest and depreciation, while our American competitors' plant was paid up; we should also have to ship our product farther. We have no natural advantages, as their whey costs no more than ours. That there is an overproduction of milk-sugar in peace-time is certain, and any one starting the business at the present time is practically taking a chance that another war may arise.

CONDENSED MILK.

From June, 1918, to June, 1919, the quantity of condensed milk used in England was 633,000,000 lb. The scarcity of butter has created a demand for sweetened condensed milk, miners and other workmen using the milk spread on bread. The amount of condensed milk, sweetened and unsweetened, made in the United States in that period was over 2,000,000,000 lb., of which 728,740,509 lb. was exported. In 1913 the export was only 250,000 lb.

The growth of the condensed-milk business has been very rapid. It is considered by those interested that there is a great future for this product in European countries. The United States is making efforts to capture the trade. Unfortunately, a great quantity of inferior-quality milk from the different exporting countries has been dumped on the market, one shipment I heard of being so bad as to have 75 per cent. of blown tins. This has been chiefly due to the lack of experienced men, as training could not keep pace with the growth of the business. In the United States condensed milk requires to conform to a fairly high standard of fat and solids not fat, but in Britain the standard is lower, so that any milk which will not pass the United States standard finds its way to the United Kingdom.

Quite a lot of condensed milk is put into barrels containing 100 lb. In the year ended June, 1919, Britain used 9,000,000 lb. of bulk condensed milk, and quite a lot is sold throughout the United States. This milk is being used in the manufacture of milk-chocolate, and in

the ice-cream business; also in the manufacture of confectionery, in which it is coming into competition with milk-powder. In the chocolate business condensed milk has the advantage that it is semi-liquid and sweet, and, provided it is cheap enough, the analysis does not matter. In the ice-cream business milk-powder is gaining ground because condensed milk requires to be tested for fat and solids not fat; and it is also necessary to use the whole barrel immediately it is opened. Milk-powder has not been long enough in use for one to definitely say that it will replace condensed milk in the ice-cream business. In the confectionery business there is no doubt that milk-powder is fast replacing condensed milk, as it is more convenient to handle and can be used in any desired quantity. I do not think that condensed milk is holding its own used as infants' or invalids' food, but I think it will be a long time before it is replaced by milk-powder for domestic purposes. Milk-powder is being principally sold in bulk, and has not reached the stage when a packet may be bought from any grocer.

CASEIN.

The Americans look upon the manufacture of casein as something to be done with skim-milk when there is no better outlet, and sum up the situation thus: One hundred pounds of skim-milk, when fed to pigs, will produce 3 lb. of live-weight pork, while the same quantity of milk will produce 3 lb. of casein, and $\frac{1}{2}$ lb. of live-weight pork if the whey from the casein is fed to pigs. If, then, the price of $2\frac{1}{2}$ lb. of live-weight pork is worth more than 3 lb. of casein it does not pay to manufacture this product. Further, the disposal of casein is regarded as impoverishing the soil on the farm, while the keeping of pigs has the opposite effect.

Some of the authorities consulted claim that skim-milk and butter-milk have too much value as a human food to be fed to animals or to be made into casein. They contend that 100 lb. of skim-milk when dried will produce 9 lb. of human food, so that 9 lb. of human food are used in producing 3 lb. of live-weight pork. The difference between live-weight and dead-weight reduced this to 2 lb. It is therefore a matter of the relative value as between skim-milk powder, pork, and casein—which article it will pay the farmer best to produce.

In view of the shortage of foodstuffs for human consumption throughout the world at the present time the question of producing the greatest quantity both from a commercial and economical point of view is, of course, worthy of consideration. It may be noted that there is at the present time a world shortage of pigs. The number in England has decreased from 3,900,000 in 1914 to 2,800,000 in 1918—a reduction of 30 per cent. The position in England in this respect is accentuated on the Continent, and in some countries the decrease in pigs is no less than 50 per cent. It will thus be seen that the price of pork is likely to remain at a high figure for some considerable time, and on that account it may be more profitable to feed the skim-milk and buttermilk to pigs rather than manufacture casein.

One factory was visited where the buttermilk was being concentrated and mixed with other foods and then fed to chickens. It was demonstrated that these chickens gained an average weight of 2 lb. in ten days, being then killed for the market. The firm interested in this product assured me that buttermilk had become so valuable as a

human food that they were considering the question of drying it for sale to bread-manufacturers.

I visited several factories in the United States where buttermilk was being dealt with in this manner, the powder being sold for 5d. to 7½d. per pound. It should be remembered that the greater portion of the buttermilk handled at the butter-factories in New Zealand would not be suitable as a human food if made into powder, owing to the fact that large quantities of bicarbonate of soda are used in neutralizing the high acidity of the cream which is produced under the home separation system. Then, again, the dairy factories in the Dominion which are at present manufacturing casein from skim-milk cannot expect to turn this material into a powder for human food on a small scale, as the quantity of skim-milk available at any one factory is not sufficient to warrant the provision of a drying plant.

Despite the views held by the Americans regarding the production of casein as compared with other products, and notwithstanding the fact that the dairy herds of France have been depleted by about two millions as the result of the war, France is still practically supplying the whole demand for rennet casein used in England, which is estimated at 1,000 tons per annum. Moreover, rennet casein is in great demand in Germany for the manufacture of combs, buttons, ladies' hairpins, toys, imitation ebony and ivory, cigar and cigarette holders, rings, water-tap handles, knife-handles, &c. It may be mentioned here that lactic-acid casein has been tried when rennet casein was unprocurable, but it was found unsatisfactory for the manufacture of the articles mentioned. Owing to lactic-acid casein being more soluble it is used in the manufacture of paints and glues, and to a very large extent for the facing of paper. It is estimated that 85 per cent. of the output of lactic-acid casein is used for the latter purpose. On that account greater quantities of this casein are required on the world's market than of that made by the use of rennet.

As the result of my inquiries I found that extensive stocks of casein were held in the United States; also that considerable quantities of lactic-acid casein were still in the sellers' hands in England, the greater demand in this case being for rennet casein. The world's demand for casein at the present time is estimated at 20,000,000 lb. yearly. Towards this quantity the United States produced 8,600,000 lb. during 1918. The indications are that there is a growing demand for casein.

Teachers' Farm-school at Ruakura.—A third annual school for teachers at Ruakura Farm of Instruction, organized by the Auckland Education Board in co-operation with the Department of Agriculture, was held from 26th to 31st January, some seventy teachers taking part. The school was divided into three sections—a men's class, a women's class, and a special dairy course. Many of the lectures and demonstrations were coincident—covering two or three sections—but the general arrangement gave the school elasticity, with opportunity for specialization. A very useful course was given by specialists of the Department of Agriculture, agricultural instructors of the Board of Education, and other educationists. The school was favoured with very fine weather, enabling most lectures to be given in the open air and facilitating close touch with the various activities of the farm.

THE FRUIT INDUSTRY OF NORTH AMERICA.

POINTS IN APPLE-CULTURE AND ORCHARD PRACTICE.

J. A. CAMPBELL, Assistant Director of the Horticulture Division.

APPLE-PRODUCTION in the United States and Canada presents many interesting features, particularly when considered in comparison with conditions and methods in New Zealand.

Apples are grown extensively in the east and west of both countries, though the conditions and results obtained are very dissimilar. In the principal apple-growing districts in the west the summer weather is dry, hot, and clear; consequently fungus diseases are not very troublesome. In the east there is more rain during the summer months, and therefore, although considerably hotter and more humid in many parts, the climatic conditions obtaining in this area more closely resemble those in New Zealand.

EASTERN FEATURES.

New York State is held to be the largest apple-producing State in the Union, while Nova Scotia possibly produces more apples than any other province in Canada. In each of the areas mentioned fruit-growing is operated on much the same plan. The trees are mainly large, and comprise some of the oldest to be found on the continent. Many of them are reputed to be seventy, eighty, and up to a hundred years of age. Forty of these trees go to the acre. Clean cultivation is not generally practised, neither is pruning nor thinning of the fruit. Owing to this, although heavy crops are occasionally secured, it will be well understood that such crops are not produced annually by the same trees. Black-spot and other fungus diseases are very prevalent, and, owing to the size and density of the trees, efficient spraying is an extremely difficult matter. Consequently black-spot in particular takes a heavy toll of the fruit crop annually. In Nova Scotia spraying practices are very similar to those followed in New Zealand, although there is a very decided tendency to drop lime-sulphur for summer use, substituting bordeaux mixture of 2-10-40 formula.

In quality the eastern apple compares favourably with anything produced in the country, but falls considerably short of the western apple in colour and general appearance. Owing to conditions under which they are grown, a large percentage of the eastern fruits are of necessity included in the lower grades or disposed of to by-product works.

CONDITIONS IN THE WEST.

In the west, as previously intimated, the conditions are entirely different. The principal apple-producing districts are all within the northern portion of what is termed the dry belt. The dry belt commences well up in British Columbia and extends to Washington, Oregon, and throughout California. The industry throughout this area is

much younger than in the east, and is conducted on much more methodical lines.

Irrigation is, of course, essential, and many object-lessons on the value of irrigation are to be found. That portion of Washington State within the dry belt and outside the irrigated areas is practically a desert, given over to sage-bush, sage-rats, and intermixed with sparse clumps of bunch-grass. This condition is to be found right up to the brink of the outer irrigation channel, while the opposite side presents a most beautiful rural picture. Viewing an orchard scene within the irrigated area, one is particularly struck by the health, size, and uniformity of the trees, the beautiful green of the alfalfa or lucerne,



ESOPUS SPITZENBERG TREE, FOURTEEN YEARS OLD.
HOOD RIVER, OREGON.

which is generally used as a permanent cover-crop, and also by the complete absence of fences, which do not exist even along the roadsides. Fruit is mainly grown in the valleys, the soil of which is deep and somewhat coarse, being composed of decayed rock brought down from the surrounding hills by the action of snow and ice in past ages.

All apple-trees are grown on the seedling stock. Pruning, as we understand it, is not practised. Young trees are lightly pruned in the first two years, resulting in the formation of four or five main branches. These are left to form the tree. Practically all subsequent growths remain untouched, other than a certain amount of thinning to prevent overcrowding. All side branches and laterals are left intact, and on these heavy crops of fruit are borne.

The principal varieties of apples grown in the north-west are Rymer's Golden, Jonathan, Delicious, Esopus Spitzenberg, Yellow Newtown, and American Winesap. These fruits generally attain a very high standard of colour, and, contrary to what one might expect, are uncommonly free of branch injury.

Six hundred packed boxes of apples per acre is considered to be a fair average yield from mature trees, but 1,000 to 1,500 boxes per acre have been obtained. Growers and others connected with the industry in the north-west attribute the high colour of their fruit to the frosty nights which obtain some time prior to the picking of the fruit.

Judging by the complete absence of shelter-belts orchards throughout the areas referred to have little to fear from high winds, although I saw several instances of wind-damage, illustrated by trees leaning away from the windy quarter in many of the outlying parts of these orchard areas. As a matter of fact, the absence of shelter-belts or any form of orchard-shelter is a noticeable factor throughout the whole of the American fruit areas visited.

Clean cultivation is carried out to some extent in the western orchards, but the common practice is to sow the area with lucerne after the trees have made sufficient progress, after which cultivation is discontinued other than a thorough disking of the area in the early spring. A later method, and one which is growing in popularity in connection with the treatment of the permanent lucerne cover-crop, is to dispense with the disking, leaving the lucerne to grow up each season and die down in the winter with no interference at all.

Adverting to the general appearance of the average north-west orchard, I must again refer to the uniformity in growth of the trees. Trees grow very much faster in these areas than is generally the case in New Zealand. It is not an uncommon thing to see a variety, such as Jonathan, Delicious, or Newtown Pippin, at seven years old half as large again, and in some cases almost twice as large, as a tree of similar age here. In considering the whole question of growth and production one has to take into account the factors of depth and nature of soil, continuous hot summer weather, water by means of irrigation when required, and stock.

THE QUESTION OF TREE-STOCK.

Although I found some difficulty to warrant my separating the factor of stock from the others, I am still strongly of the opinion that the seedling stock is largely responsible for the superior growth referred to, and succeeded in obtaining some fairly reliable information in support of this view. A case in point is the Deufar orchard, some 4,000 acres in extent, situated within the dry belt in the State of Oregon. This orchard is made up of apple varieties commonly grown in New Zealand, and grown very largely under similar conditions, with the one exception that they are worked on the seedling stock. All these trees showed the same superiority of growth as those grown in the irrigated areas. The seedling is the stock used almost entirely throughout the United States and Canada, and I am quite convinced that, grown under their conditions, it results in a stronger tree.

Seedling stocks are, of course, liable to attacks of woolly aphid, a fact which New Zealand and Australia learnt to their cost many

years ago. It was owing to the ravages of this disease that the Northern Spy stock was adopted. Woolly aphid affects the roots of the American trees to some extent, but it must be remembered that the severity of the average American winter has no doubt a detrimental effect on the progress of this insect pest. On the other hand, under the mild conditions in this country woolly aphid thrives abundantly, and on this account the use of the seedling stock is precluded.

My reason for particularly mentioning the use of the seedling stock in America, and the apparent advantages gained, is not with the idea that this country should adopt a similar stock, but mainly to emphasize the fact that the growth of an orchard is very largely dependent upon the class of stock on which the trees are worked, and, further, to bring under the notice of those in the industry the possible advantages to be gained by a systematic search for a stock more suitable for our requirements than the Northern Spy. Nurserymen in the past adopted the Northern Spy stock in the interests of the fruitgrower. This stock may still prove on investigation to be the best all-round stock for our purposes, but such should not be taken for granted. There are many other blight-proof varieties of apples which may possess characteristics superior to that of the Spy.

It may be added that investigations along these lines are being carried out at our Tauranga and Arataki Horticultural Stations, but, no doubt, valuable assistance in this direction, which might ultimately result very beneficially to the fruit industry, could be given by growers and nurserymen.

NOTE.—The subjects of co-operation and standardization were dealt with in last month's *Journal*.

Haymaking in the South.—In a recent report Mr. R. P. Connell, Instructor in Agriculture, Dunedin, observes, "In view of the comparatively long and severe winters experienced in Otago and Southland one cannot but remark on the insignificant amount of hay which is saved by the farmers generally in this area. One is told that hay-making is unpopular because of the risk arising from the variable weather. If this is the case ensilage-making should be more generally practised, but the success of the few farmers who do attempt hay-making seems to point to the fact that farmers may profitably undertake haymaking much more extensively than obtains at present."

Pasturing Pigs on Lucerne.—Grazing lucerne with pigs has been shown to be a very satisfactory method of utilizing that crop, and one of the cheapest ways of producing pork. An acre of good lucerne pasture, if supplemented with a 2-per-cent. ration of maize or barley, will support six to eight sows and fifty to seventy suckling-pigs for a period of about sixty days in early summer. During this time the pigs should gain 25 lb. to 30 lb. each. The same area (1 acre) supplemented in a similar way, has an average pig-carrying capacity of about 2,500 lb. of live-weight for the growing season. Farmers wishing to increase their pig stocks on small areas should take special note of this.—K. W. Gorringer, Instructor in Swine Husbandry.

CONCRETE WATER-TANKS.

CONCRETE tanks for holding water may be built in a variety of ways, either round or square, and underground or above ground. If the ground consists of solid material, such as rock, the cheapest method is to excavate a square chamber of the desired capacity, and to plaster or otherwise coat the inside to render it watertight. If the rock is "papa" it should be watertight without treatment. In fact, it is always worth while to make a trial without inside treatment, and if the tank leaks, then take steps accordingly. If the rock is much broken and irregular it will be easier to cover the floor with a few inches of fine and fairly rich concrete, sufficient to even up the irregularities and make a regular fall to the scour-outlet. Then set up timbering inside as close as practicable to the rock and fill in with similar concrete. The side thickness should not be less than 4 in., else it is difficult to make a good job. Tanks may be excavated in unyielding material other than rock, such as tight gravel, and made watertight as previously indicated, but there is always the risk of slight yielding of the earth causing cracks in the concrete, with attendant leaks, which are hard to stop.

If the ground is unsuitable for an underground tank of the unreinforced type described, the best solution is a circular tank standing above ground and reinforced principally with circumferential rods proportioned according to the diameter and depth of the tank proposed. It is also advisable to reinforce the bottom, which should be placed a foot or two below the surface to ensure the best bearing obtainable. Differential settlement of the ground under the weight of the tank and water may occur, and would wreck the tank if it were not properly designed and reinforced. The conditions of each location vary so much that no hard-and-fast rule can be laid down. The erection of reinforced tanks should not be attempted without expert advice and a proper plan. The importance of a scour-valve in all cases should not be overlooked, as it will save a great deal of trouble in cleaning out in the future. It should be of ample size, with the bottom of the tank graded to fall towards it from all points. With underground tanks the scour-outlet can be arranged by having the excavation on a hillside or bank.

A square underground tank to hold, say, 4,000 gallons should be 10 ft. by 10 ft. by 6 ft. 6 in. deep (net). If made too deep it is difficult to get the excavated material out. It could be made 12 ft. by 12 ft. by 5 ft., but the shallower the water the warmer it would get, and if roofed over the cost of the roof would be about 40 per cent. greater. If a circular raised tank is built its proportions will depend on whether it is to be roofed or not. If roofed it should be 9 ft. 6 in. in diameter by 9 ft. 6 in. deep.—*Public Works Department.*

MEASUREMENT OF STACKS TO FIND WEIGHT OF CONTENTS.

A. MACPHERSON, Fields Instructor, Christchurch

THE weight of a stack may be closely determined by measuring to ascertain the number of cubic feet or yards, and obtaining the weight per cubic foot by actual weighing. The number of yards per ton will depend on the solidity of settlement of the stack. Following is the hay and straw weight table :—

36 lb. avoirdupois of straw equals 1 truss.
56 lb. avoirdupois of hay (old) equals 1 truss.
60 lb. avoirdupois of hay (new) equals 1 truss.
36 trusses equals 1 load.

In Britain hay is called "old" after the commencement of September, when it has had time to settle and get thoroughly dry. Allowing more margin, however, it would be safe to assume that hay could be considered as old after being six months in the stack. A load of old hay should weigh about 18 cwt., a load of new hay about 19 cwt. 32 lb.

The weight of hay per cubic yard in the stack depends on the nature of the hay, its age, the size of the stack, and the part of the stack taken. It varies from 112 lb. to 300 lb. per cubic yard. For different conditions of hay and stacks the number of cubic yards to a ton will approximately vary as follows :—

Condition of Stack.			Oblong or Square Stacks. Cubic Yards.	Round Stacks. Cubic Yards.
Not well settled	..	..	12	13
Fairly settled	..	..	10	11
Very compact	..	..	8	9

Second-cut clover hay will require 13 or 14 cubic yards to a ton.

The weight may be ascertained very accurately by actually measuring the cubic contents of a truss, and from this calculating the weight of a cubic foot. The following shows the number of cubic yards in a ton at different weights per foot :—

Weight per Foot. lb.	Yards to a Ton		Weight per Foot. lb.	Yards to a Ton.	
4.18	..	20	6.37	..	13
4.36	..	19	6.87	..	12
4.60	..	18	7.50	..	11
4.88	..	17	8.25	..	10
5.18	..	16	9.18	..	9
5.53	..	15	10.31	..	8
6.00	..	14	11.85	..	7

For calculating the contents of oblong or square haystacks (Fig. 1) take the length and breadth of the stack in feet and inches half-way between the upper part of the stack-bed and the eaves, A to B and B to C, an allowance (from 3 in. in trimmed stacks to 8 in. in others) being made in each measurement for the loose outsides; then take the height from the upper part of the stack-bed to the eaves, D to E.

For stacks with gable ends take one-third of the perpendicular height of roof E to F.

For stacks with hipped ends take one-fifth of perpendicular height of roof.

Example with Fig. 1.

Breadth of stack (A to B)	..	..	..	25 ft.
Length of stack (B to C)	..	..	..	50 ft.
Height from upper part of stack-bed to eave (D to E)	..	..	12 ft.	
One-third of height from eaves to ridge (E to F) (9 ft.)	..	..	3 ft.	
Total average height of stack	..	..	15 ft.	

Contents of stack = length $\times$ breadth $\times$ total average height :—

$$\begin{array}{r}
 25 \\
 \underline{50} \\
 1250 \\
 \underline{15} \\
 6250 \\
 \underline{1250} \\
 27 \overline{)18750} \text{ cub. ft.} \\
 694.4 \text{ cub. yd.} = \text{contents of stack.}
 \end{array}$$

Having a stack fairly well settled, and weight per cubic foot 8.25 lb., this would give, according to table, 10 cubic yards to the ton. Therefore weight of hay in stack is $694.4 \div 10 = 69.44$ tons.

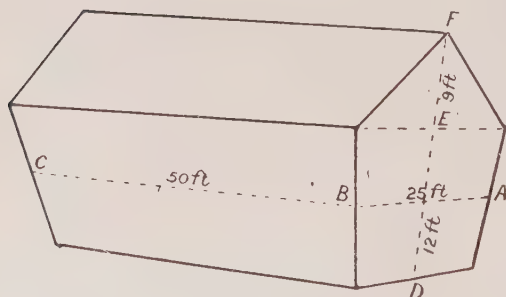


FIG. 1. OBLONG OR SQUARE STACK.

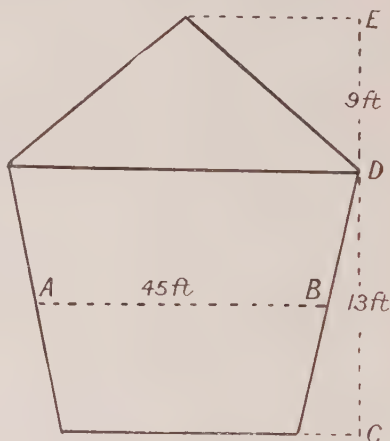


FIG. 2. ROUND STACK.

To determine the number of cubic feet contained in a round stack with a conical top (Fig. 2) the average girth must be measured at AB. The mean or average height is ascertained by taking the perpendicular height from the base of the stack to the eaves CD and adding to it one-third of the perpendicular height from the eaves to top DE.

Multiply the average girth, 45 ft., by itself :—

$$\begin{array}{r}
 45 \\
 \underline{225} \\
 180 \\
 \underline{2025} \\
 \text{Multiply the result by } .0795 \\
 10125 \\
 \underline{18225} \\
 14175 \\
 160.9875 \text{ sq. ft.}
 \end{array}$$

Multiply then by height C to D = 13 ft. + one-third height of D to E = 3 ft. = 16 ft. :—

$$\begin{array}{r} 160 \cdot 9875 \\ 16 \\ \hline 9659250 \\ 1609875 \\ \hline 2575 \cdot 8000 \end{array}$$

If hay in stack is fairly well settled and weight per cubic foot 8·25 lb., this would give, according to table, 10 cubic yards to the ton, by which figure divide, as follows :—

$$\begin{array}{r} 27 \overline{) 2576} \text{ cub. ft.} \\ 10 \overline{) 95 \cdot 4} \text{ cub. yd.} \\ 9 \cdot 5 \text{ tons.} \end{array}$$

The following table giving the weight and volume of different kinds of straw will be found useful for reference :—

				Weight per Cubic Foot. lb.	Cubic Yards per Ton.
Wheat ..	..	..	..	3·5	23·3
Oat ..	..	..	..	3·4	24·3
Barley ..	..	..	..	2·8	30·2
Pea ..	..	..	..	2·4	32·0
Bean ..	..	..	..	2·3	33·7

Field-day at Weraroa.—A field-day, attended by about a hundred farmers, was held at the Central Development Farm on 29th January. An interesting and useful time was spent viewing the farm and its operations under competent guidance. Among the live-stock the Red Poll herd attracted special notice. The seed-testing laboratory of the Biology Section also received much attention.



RYECORN FOR THATCHING AT RUAKURA.

ALUMINIUM HONEYCOMBS.

G. V. WESTBROOKE, Apiary Instructor, Auckland.

LAST October the Horticulture Division received from America two sets of the new metal honeycomb. One set each was sent to the Department's apiaries at Tauranga and Ruakura. At Tauranga the ten frames were put into a fairly strong colony, being inserted between the wax combs alternately. Although at the time there was only a slight flow of nectar the bees accepted the aluminium combs at once, first sealing up the base of the cells. In a few days the combs that were placed in the brood-chamber contained worker-eggs, which in due time hatched out. The metal combs in the super are, at time of writing, well filled with capped honey. The photograph shows one of



ALUMINIUM COMB USED AT TAURANGA APIARY.

the Tauranga combs with sealed brood and capped honey in the top corners. The bottom corners show part of the aluminium comb which has not yet been utilized by the bees. This comb was purposely selected to show the different stages. The other combs were fully occupied by brood or honey. At Ruakura each frame of the set was placed in different hives, so as to ascertain if they would be generally accepted. In no case were they discarded by the bees, but were as readily accepted as sheets of wax foundation.

These metal combs are not merely sheets of foundation, but are Langstroth frames in which thin strips of aluminium are ingeniously worked into the shape of worker-cells. These strips are secured to the frame by six strong wires running from the top to the bottom bar. The surface of the cells is slightly brushed with beeswax. The bees build on to these edges until the combs are such depth as the spacing

of the frames will permit. It is claimed that these metal combs enable greater production of honey, owing to the saving of time in building the wax; also that they extract cleaner, and save the loss of broken combs, destruction by insects, &c.

At the recent field-day held at the Ruakura Apiary these combs attracted considerable interest. At the close of the day a trial was given of extracting the honey from them. One comb from Tauranga, containing thick honey, was also placed in the extractor. The Ruakura combs, containing light honey, extracted readily. The comb with the thick honey, on extra speed being applied to the extractor, also yielded most of its honey, only a few cells retaining a small quantity. The results of this experiment seem to offer a possible solution of the thick-honey problem, as in no case did the combs, in spite of the high speed, show any signs of breaking. In fact, it is reasonable to suppose that with a power-driven extractor they would stand a very much greater speed.

Judging from the results of the experiment, the claims of the manufacturers do not appear at all unreasonable, although some beekeepers are afraid that metal combs would not do for the brood-chamber in the colder climate of the South Island. This, however, is a matter that will be further tested by the Department, and these metal combs will be tried on a larger scale next season, together with aluminium sheets which have just arrived from England. These have been put through the embossed rollers used for wax-foundation-making at Ruakura and have taken the impression of the worker-cells. They will be tried forthwith and reported on later.

Bee-culture at Avonhead.—At the Avonhead Training-farm for returned soldiers, near Christchurch, forty colonies of bees have been established, including ten for queen-raising. Experiments are being conducted with three kinds of hives.

Field-day at Ashburton Experimental Farm.—A field-day at this farm, held under the auspices of the local Farmers' Union on the 10th December, was attended by some two hundred people, who displayed much interest in the work undertaken.

Analyses of Limestones.—Recent analyses of limestone samples by the Chemistry Section gave the following percentages of carbonate of lime: Hastings, 88.5; Carterton, 86.5 and 91; Puwera, 84, 75, and 71; Warkworth, 72.

Duroc Pigs.—When at the Agricultural Fair at Toronto last year Mr. W. Dempster especially noticed the fine exhibit of Duroc pigs, a favourite breed in Canada. In colour the Duroc resembles the Tamworth, but is shorter in the legs and broader in the shoulders, while the hams are also well developed. The body is of good length and makes first-class bacon. These pigs mature very early, and are also easily fattened.

POULTRY ON THE FARM.

F. C. BROWN, Chief Poultry Instructor, Wellington.

A FARMER'S wife recently wrote for advice as to the poor results obtained from her poultry, stating that from seventeen hens only one thousand two hundred eggs had been produced for the year, or an average of a little over seventy eggs a bird. She questioned whether it would not pay better to get rid of the fowls and buy the eggs required for the house. The answer to this is a decided Yes, for if the same number of high-type laying-stock were kept, and fed and managed to the best advantage, at least double the number of eggs would have been produced. Even then from such a small flock an average of some one hundred and forty eggs for the year could only be considered a low one.

I would urge farming-folk who fail to make their poultry pay to ask themselves the following questions: "Does the poultry receive the same care and attention in regard to breeding as the dairy herd or the other classes of live-stock on the farm?" "Are they fed regularly, and to the same advantage?" "Are the other classes of live-stock kept beyond their best period of usefulness and allowed to die of old age, as is often the case with the poultry?" "Are the fowls properly housed and protected from unfavourable weather conditions, or allowed to roost in a tree or on the back of a dray?"

Those in the position of my correspondent would be well advised to do away entirely with their present stock and keep half the number of a purebred laying-strain. The cost of food would be less, while the actual return of eggs would be greater. As an instance, I may mention seeing last year on one farm a flock of one hundred pullets which gave an average of over two hundred eggs each for the year. What can be done on one farm can be done on another, providing that the poultry is given the same care in regard to breeding and general management.

This brings to mind a recent conversation with three farmers, two of whom declared that with the high cost of food it was impossible for fowls to show a profit over their keep. They were probably quite right, but only so far as the fowls they kept were concerned, these being generally of a nondescript collection. The third farmer had something better to say, and gave a clean-cut statement which showed that from eighty hens his wife made a profit of over £30 for the year, after deducting the cost of feed. In other words, she received this amount for the time spent in caring for her birds. Of course, seeing that the birds had a free range, allowing them to pick up a good part of their living, the net return is not by any means exceptional. If the flock had consisted of nothing but high-type young birds, and had been given the best of management, the profit would have been much higher.

If poultry is to be kept profitably on the farm it is imperative that old-time methods be changed. As success chiefly depends on the class

of stock kept, it is essential that the old barn-door or mongrel fowl be got rid of and none but the improved laying-type kept. Egg-production must be made the main aim, the table side of the business being treated as merely an adjunct.

THE BREED TO KEEP.

As to the best breed to keep, White Leghorns are undoubtedly the most popular from an egg-yielding standpoint, but they are unsatisfactory sitters. In fact, with a good laying-strain it is rare for them to show any sign of broodiness. Therefore, where artificial means are not adopted for hatching and rearing, the White Leghorn cannot be considered as an ideal farmer's bird. On the other hand, the Black Orpington or White Plymouth Rock will prove suitable breeds. Given the laying-strain of these general-purpose birds, the farmer has profitable laying-stock, and cockerels will pay to market, while he can also depend on having hens for hatching and rearing purposes. Of course, it is not the old exaggerated type of these breeds—created for the show-pen—which is recommended, but the medium modified type, in which egg-producing power has been developed with little or no harm to table qualities. Where the non-sitting breeds are kept—Leghorns, Minorcas, &c.—the only thing to do is to have an incubator, or purchase day-old chicks from a reliable breeder and rear them in a fireless brooder.

MANAGEMENT.

Having an egg-producing strain is only one essential requirement. If the birds are to give a maximum egg-yield, and consequently the highest profit, they must be hatched at the right time. To get long-season layers to commence in the month of April the heavy breeds should be hatched in August and the light breeds in September or early in October. The birds should receive liberally food of the best quality. In this connection it should always be remembered that the heavy layer cannot be overfed if the food is of the right quality. The day has gone for saying that a hen is too fat to lay. If she becomes too fat it merely indicates that she is not of a laying-type and should be culled out.

HOUSING.

Above all, poultry must be properly housed. All that is required is a partly-open-fronted lean-to building in which the birds can roost in comfort, remain during unfavourable weather conditions, and yet have ample exercise by scratching in litter, in which the whole-grain foods should be scattered. For large flocks the house should be 16 ft. deep, but with smaller numbers it is not practicable to have the structure so deep as this, and the shape must be squared up. In a general way the following dimensions are recommended: For fifty birds, 15 ft. deep by 12 ft. wide; for twenty-five birds, 10 ft. deep by 6 ft. wide. In providing housing-accommodation, and where runs are attached, it may be taken as a general rule that nothing less than 3 square feet of floor-space (to be ascertained by multiplying the length by the width) should be provided for each bird. In arranging the perches, 7 in. at least should be allowed for light breeds and 8 in. for heavy breeds. Do not have the perches on the old step-ladder

fashion. Keep them level and about 15 in. from the floor. They should also be removable, so as to facilitate cleaning and the prevention of insect pests. The floor of the poultry-house should be formed in such a manner that the birds have a thoroughly dry under-footing even in the wetter months of the year. With this in view it should be a few inches higher than the surrounding ground-level. Well-puddled clay, covered with tar and sand when thoroughly dry, makes a suitable floor for a poultry-house. Of course, concrete makes the best flooring-material of all, but this is comparatively costly, especially where suitable shingle is not near at hand. It is important to have a wire-netting run attached to the house, so that the birds can be confined during the morning until most of the eggs are laid. Where a run is not provided the birds are encouraged to lay anywhere, with the result that the eggs are often stale and dirty, and cannot be marketed with confidence.

CLEANLINESS.

By having the birds accommodated in a good house near the homestead the feeding and watering can be carried out in comfort in any weather, while the eggs can be gathered in a fresh, clean condition—an essential to obtaining their best market value. The house must be regularly cleaned, and given a periodical spraying with a strong disinfectant. The nests must also be kept in a sanitary state, and the nesting-material frequently changed. Strict attention to cleanliness is the secret of maintaining birds in a healthy thriving state, and of preventing insect pests.

BREEDING.

Another important point that must not be overlooked is the necessity of providing a breeding-pen. For the farmer to improve or maintain a heavy-laying flock he must get away from the common practice of indiscriminate breeding, such as the crossing and recrossing of different breeds generation after generation, and using eggs for hatching purposes merely because they happen to be at hand. Such a course tends towards reversion to the ancestral type and consequently a reduced egg-yield. The best advice that can be given is to keep only one breed of all black or all white, and to breed these in a state of purity whenever possible to do so. Such birds will not only give a better egg-return, but will be more uniform and attractive compared with the motley collections seen where crossbreeding is resorted to. Even when nothing but purebred strains are stocked it is necessary to have a breeding-pen, so that the eggs from none but the best laying-types are used for reproductive purposes. It must be remembered that there are good and bad layers in all breeds and strains, and that the laying-capacity may be developed or reduced according to the particular class of birds bred from. The law of nature is that like produces like, so that if weak parents are bred from, weak progeny will be the result.

CULLING.

Still another important matter is to retain in the flock only birds that are showing or likely to show a decent profit over their keep.

Even after the first laying season the weak types should be culled out and only the best specimens retained for the second season. As a general rule, it does not pay to keep a bird after her second season of production, unless, of course, she is a desirable breeding-bird. Usually during the second year the egg-yield is about 30 per cent. lower than in the pullet season. After the second season the yield rapidly declines, while the production is mostly at a time when eggs are cheapest.

In regard to the weeding-out of unprofitable stock, the farmer must realize the importance of marking his chickens in order to distinguish the young from the old when culling is necessary—as it is every season if only profitable stock are to be kept. There is no hard-and-fast rule of telling the age of a bird after she has attained an adult stage of development. This being so, the punching of a distinct mark in the web of the foot is a good way of providing a means of age-determination. A punch for the purpose can be obtained for about 2s. 6d. The best time to cull a flock is just before the moulting-period. All things being equal—in regard to the time for hatching and also the general conditions under which the birds are kept—it is usually a safe course to discard the first birds to show signs of moulting, while the late moulters should be retained for laying and breeding purposes.

NEW SOUTH WALES STATE ORCHESTRA AT RUAKURA.



While at Hamilton last month the members of the orchestra visited the Ruakura Farm of Instruction. Special interest was taken in haymaking operations then proceeding. The visitors were entertained at afternoon tea at the homestead by Mrs. Green. In the group M. Henri Verbrugghen is indicated by an arrow.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE ENSUING EXPORT SEASON.

FAIRLY satisfactory progress has been made during the last three or four weeks relative to the export of fruit. Advance in this direction has been necessarily slow, owing mainly to the existing system of shipping-space control. Local authorities can do no more than recommend, the actual allotment of space being entirely in the hands of the Imperial authorities. However, through the efforts of the Prime Minister, made upon the recommendations of the New Zealand Fruitgrowers' Federation and the Department of Agriculture, space for the shipment of sixty thousand cases to the United Kingdom has been definitely secured. The local shipping committee has placed the allotment of this space on a *pro rata* basis in the hands of the New Zealand Fruitgrowers' Federation. In addition space has been secured for some twenty thousand cases for shipment to the United States and Canada.

The question whether or not this amount of space will be sufficient to satisfactorily meet the present season's requirements is causing some concern to growers and the Department alike. The primary considerations in connection with securing further space are: Firstly, the difficulty of inducing the Imperial authorities to allot for the carriage of fruit a greater proportion of the limited amount of cool-storage shipping-space at their disposal; secondly, whether sufficient fruit would be available to readily fill any additional space secured; thirdly, in the event of sufficient fruit being available, whether, under existing conditions, it could be graded and packed in accordance with the standards required for export.

An indication of whether further space is in demand should be available as a result of applications for the space now being offered, closing on 16th instant. Should the applications suggest that further space is in demand every attempt will be made to secure it, and the matter of the satisfactory preparation of the fruit required will be a matter for the packers' attention.

Supplementing last month's notes relative to the care necessary in handling fruit for export, I would point out that New Zealand fruit is scarcely known on oversea markets. It has yet to make its name. On the other hand, fruit from the United States and Canada is well known and appreciated on the markets of the world, owing to the high standard of the North American pack. At the present stage we aim not at competing with but following so far as possible those countries on the principal oversea markets. Therefore it is essential that our pack should be of equal quality, and that this be attained at the outset. We propose adopting the same grade terms used by the United States and Canada. The advantages of so doing are obvious. Buyers will be enabled to continue business throughout the year with freedom and con-

fidence, and, further, considerable advantage will come to us through the extensive advertising which has already been done relative to the grade terms used. These advantages, however, depend entirely upon our pack being of a standard equivalent to that represented by the American grade terms.

—J. A. Campbell, Assistant Director of the Horticulture Division.

AUCKLAND.

During March some varieties of stone-fruits will remain to be harvested, but work in the main will be directed towards the effective marketing of the greater part of the mid-season pip-fruits.

Up to the time of writing, brown-rot has been little in evidence as compared with the last two seasons, but a short spell of humid conditions would be conducive to fresh infections; therefore continue applications of commercial lime-sulphur, 1-125, to peaches, plums, and nectarines. This will also serve as a check to rust infection.

Despite the dry weather conditions experienced black-spot persists, leaf-infection being very marked in apples. Arsenate-of-lead sprays should be continued for the control of codlin-moth. A further hatch is to be expected, infecting later varieties of apples, pears, and quinces. When applying this spray add commercial lime-sulphur, 1-100, as previously recommended. Woolly aphis may be expected to attack with renewed energy during the fall period, and combative measures in the use of Blackleaf 40, 1-800, should be adopted. Continue applications at intervals throughout late summer and until such times as the falling of leaves permits of the use of oil sprays.

Several forms of canker are causing damage to orchards in the district, and in cases where such infection is identified growers should use every endeavour to remove parts so infected by cutting away with a sharp knife and destroying them by fire, as they are a source of further infection. The wounds thus made should be washed with corrosive sublimate, 1 part to 1,000 parts of water, using a small brush, and painted over afterwards with coal-tar. After each cut the knife or seccateurs must be sterilized by dipping in a solution of formalin, 1 part to 20 of water. Care must be exercised in the use of corrosive sublimate, which is deadly poison.

The completion of budding operations should be pushed forward while the sap is well up. Summer pruning may now be finished. Stone-fruit growers are advised to thin out heavy growth, especially that on the inside of the trees, so as to admit light and air.

The immense value of thorough cultivation has been amply demonstrated this season, in which such dry conditions have been experienced. There is not likely to be a better object-lesson in this regard for some time to come, and it is to be hoped that the sufferers will take a warning and note their shortcomings in this important work.

Some citrus-growers are experiencing trouble with the cottony cushion scale (*Icerya purchasi*). This may be dealt with in the same manner as thrip; immediately young growth is sufficiently hardened to permit of it spray with red oil, 1-40. Further dying-back of the tips of the previous season's growth on citrus trees touched by last season's frosts is in evidence, and as this invites attack from the citrus borer all such dead wood should be removed, cutting well back below the dead portion and immediately above a bud.

Spraying summary: The compounds and strengths given in last month's notes are again recommended.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

Cultivation should be continued wherever possible, in order to maintain moisture sufficient to mature the fruit and promote development of sound buds for next season. The season being a dry one, cultivation has proved a boon where carried out properly.

The various spraying compounds and dilutions mentioned in last month's notes are still seasonable for the control of pests and diseases, and little can be added except to emphasize the necessity of safeguarding against a late attack of codlin-moth and infection of black-spot.

—W. M. Rice, Orchard Instructor, Hastings.

MOTUEKA.

By the time these notes appear in print the export season will have arrived. The thinning from the trees of our fruit sources for shipment will undoubtedly be to the advantage of fruit left on the trees until a more ripened stage is attained. When selecting from the trees the fruit required for export, this fruit should also be gathered, thus relieving the trees of superfluous inferior fruit and giving added zest to the trees and remaining fruit.

Growers will be well advised to pack consistently to the standard grades throughout the season. They should not by any means be disheartened at any little set-backs experienced in the early stages of their initial efforts. It must ultimately become the backbone of the selling system to have uniform recognized standards that buyers can depend upon.

Spraying measures for the coming month will consist of keeping a coating of arsenate of lead on the fruit to prevent attack by late broods of codlin-moth, also to prevent the ravages of leaf-roller caterpillar in fruit after storage. At the same time a late application of lime-sulphur, 1-120, on fruit for storage will tend to reduce largely the development of black-spot on fruit after being placed in storage, as was experienced last season.

—W. T. Goodwin, Orchard Inspector, Motueka.

CANTERBURY.

Leaf-roller caterpillar will probably become troublesome during March, and it will be advisable to give another spraying of arsenate of lead for its control. This will also cope with any late attack of codlin-moth, especially in the late varieties.

Powdery mildew is on the increase very badly all over the district, and many varieties of apples, especially Sturmers, are suffering in consequence. Much good can be done by cutting off the affected laterals and burning them, giving the trees a good spraying with lime-sulphur, 1 to 100 or 120, or atomic sulphur, 5 to 10 lb. per 100 gallons of water. This will also help to check the spread of red mite, thus preventing the laying of winter eggs. Where woolly aphid is present continue to spray with Blackleaf 40, driving the spray well into the colonies. By doing this many of the winged forms that will be appearing about this time will be destroyed. Good results have also been obtained by giving the trees a thorough application of red oil at strength 1 to 50 or 80, after the fruit is picked.

Any budding not done in February may be continued in the early part of March, choosing well-matured buds from healthy trees for the operation.

There are still many growers too careless about the marketing of their fruit, and already several lines have been condemned and destroyed locally. It should be known that fruit affected with codlin-moth, mussel scale, red mite, leaf-roller caterpillar, or black-spot is not allowed to be placed in the market for sale, and consequently such affected fruit should either be destroyed in the orchard, thus saving further trouble and expense, or, with the exception of cases of moth infection, be dealt with as follows: Fruit affected with mussel scale and red mite may, after being thoroughly cleansed of these pests, be placed on the open market or disposed of to a canning-factory. Fruit affected by leaf-roller caterpillar or black-spot must be destroyed. Growers have been furnished with the necessary departmental authority in the form of a permit issued by the

Grading and packing still leave much to be desired, and it would be well for growers to make themselves acquainted with the proposed regulations for local sale and work accordingly. It will save much trouble when the regulations are made compulsory. All information can be obtained upon application at the office of the Orchard Inspector.

—G. Stratford, Orchard Inspector, Christchurch.

OTAGO.

At time of writing the stone-fruit harvest is in full swing, and good crops of early varieties of apples and apricots are being marketed. Both black and green aphid are troublesome in some orchards, and greater attention should be paid to them. Rust on apple-wood will not develop where this pest gets a good grip. Spray with lime-sulphur, 1-500, and repeat if the pest is still in evidence. Rust has also made its appearance. The later varieties become badly affected in both

size and appearance if this fungus disease is not kept in check. Use lime-sulphur, 1-140, in cool weather if possible, as injury sometimes results if too hot. Red mite is also affecting some of the peaches. Lime-sulphur at the same strength will keep the pest in check; or atomic sulphur can be used at 8 lb. to 10 lb. to 100 gallons water. Black-spot is not nearly so prevalent as last season, and not likely to be if the weather keeps good, but if damper weather sets in it may become infectious later, and the trees need to be carefully watched. Where applications of lime-sulphur or atomic sulphur are being given for powdery mildew no trouble should arise with black-spot.

Owing to the backward season codlin-moth was late in hatching, but there are a fair quantity of apples affected through insufficient spraying at the critical time. These should be picked off and destroyed before the grubs escape to their hiding-places. Cherry-leech is not receiving the attention it should in some cases; neglect to destroy this pest results in stunted trees and poor crops on pears also. An application of arsenate of lead at 1-30 is all that is required.

Summer pruning can now be done. Clean out the centres of stone-fruit trees. The fruiting-wood will ripen up better for next season, and in the case of late peaches their ripening will be advanced. Apples can also be summer-pruned now, but not too drastically. Clean out the centres prior to spraying for woolly aphids, which is now becoming far too prevalent, using Blackleaf 40 for the purpose, at 1-800.

Budding can still be proceeded with, choosing well-ripened buds for the purpose. It is a good plan to put plenty of buds in. Some can be removed later if too many succeed.

Spray strawberry plants now for leaf-spot with bordeaux, 4-4-40.

—J. H. Thorpe, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

MANAGEMENT OF THE DEVELOPING PULLETS.

NEXT month should see the majority of the pullets exhibiting signs of coming to laying-point, such as making a cackling noise, showing a red developed comb, a fullness in the abdominal region, and generally an adult shape. Therefore no time should be lost in getting the young birds into their permanent winter quarters. It is of the greatest importance that they be well settled down before their productive season commences. Changing the pullets from house to house at this particular stage of their development is a most common cause of their going into a moult with the adult birds, and this at a time when eggs rapidly advance in price. The same result may be brought about by changing the food, or by subjecting the birds to fright by rough handling, &c. It will therefore be seen that the more uniform the treatment pullets receive just before or after they have attained a laying-stage the less risk will there be of their going into this premature moult. Of course, very early-hatched pullets will probably be laying before this, but in most cases they will moult in the late autumn even when given the best of care and attention. As a rule, however, the moult is a light one, and if the birds are well fed and housed they will soon recover and attain a productive condition.

On no account should a pullet be encouraged to lay before it reaches an age of six months at the least. The great drawback to too early

maturity is that the bird seldom grows to a desired size, nor lays a good marketable egg, and consequently never makes a desirable breeding-specimen. By this it is not to be inferred that the laying-period should be delayed by supplying a scant ration or one of inferior quality; indeed, the feeding of the growing pullet cannot be too liberal, but it should be plain, consisting chiefly of good sound grain materials, and as much green stuff as it will eat. Where the danger lies is including in the ration too much rich food, such as meat or its substitutes. These foods tend to stimulate the reproductive organs before proper development has been attained.

Hand-in-hand with liberal feeding should go clean and comfortable housing. Never place the pullets in quarters where adult stock have been kept, until such quarters are well cleaned and the whole of the interior of the house is given an application of whitewash or a spray with strong disinfectant. This will give the assurance that no insect pests are present. If the pullet is to maintain her bodily health and produce a heavy yield of winter eggs it is of the greatest importance that she be kept free from vermin, particularly the red mite. See that the floor of the house is maintained in a dry state. It should be raised a few inches above ground-level to assure this end. It should also be covered with straw or similar litter, in which the whole-grain food is daily fed. This will keep the birds busy in scratching for the grains. Always remember that it is the dry-footed hen, given ample space for exercise under cover, that gives the best return during the cold wet months of the year. Care must be taken that the front of the house is well opened up, so as to admit an ample supply of fresh air and sunlight to all parts of its interior. In order to prevent draughts the sides and back walls should be free from cracks. The slightest crevice or crack should be stopped, or colds, roup, &c., are apt to follow as a result. The houses should be occasionally visited after dark, and if any of the birds are found to be sneezing or breathing heavily the cause should be looked for and removed at once. A little Condyl's crystals put into the drinking-water—say, sufficient to give it a rich pink colour—will usually check and prevent colds from spreading.

When the pullets are commencing to lay they should be watched for a time, and discouraged from laying their eggs in odd corners of the house instead of in the nests. Generally speaking, if one bird is allowed to lay its eggs on the floor of the house others are apt to do the same. This means that the eggs are likely to be covered up in the litter, and are not gathered in a fresh condition. Placing an obstruction where the bird has acquired the habit of laying, having the nests slightly darkened, and providing ample nest-boxes as well as nest-eggs will usually have the desired effect. Poultry-keepers should not on any account let high prices for eggs lead them to overforce the young pullet with rich foods, or ovarian troubles are almost sure to result. To secure a good winter egg-yield some forcing-material is essential, but this should be introduced by degrees and at all times used with strict judgment.

It is advisable in poultry-keeping generally to neglect no detail in regard to cleanliness, proper feeding, housing, and general management, but with the pullet intended for winter laying this attention to detail is imperative.

LAMENESS IN YOUNG DUCKLINGS.

Many complaints have reached me of late regarding lameness and loss of leg-power in ducklings that were being reared by artificial means. This may be due to having the drinking-vessels insufficiently deep to allow the birds to get their heads well under the water for keeping their nostrils from becoming clogged up with food, &c. Another and the most common cause is dampness in the sleeping-quarters—allowing the ducklings to sleep on wet bedding-material. Curing this leg trouble is out of the question; the only safe course is to prevent it. The first step in this direction is to provide drinking-vessels which will allow the young birds to get their heads well under the water. Further, care must be taken to keep the bedding-material in a dry state, and with this in view the drinking-vessels should be placed well away from the sleeping-compartment. This will go a long way to prevent the droppings from the birds, after drinking, coming into contact with the bedding. In furtherance of this end a good plan is to have a low wooden frame covered with small-mesh wire netting, on which to stand the water-fountain, while a flat dish is placed underneath. Then the droppings, when the ducks are drinking, will fall into the dish. This will help greatly towards keeping the quarters in a dry state and the birds healthy.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

WHEN removing honey from the hives the question of winter stores should not be lost sight of, especially in view of the existing sugar-shortage. The improved price obtained for honey during the past few years has tempted many beekeepers to extract bare and feed back sugar as required, but they would be well advised to make sure the bees have plenty of stores to last them until the next season's honey is coming in freely. For this purpose each hive would require not less than 40 lb. of honey. In order to arrive at the amount of honey in the hive it will be necessary to make a thorough examination. Do not be content to simply leave the bottom box, as so many beginners do, assuming that it is full of honey. In most cases it is mainly composed of brood, and losses have been frequently suffered in this way. Half-starved colonies never winter well, and open up poor in the spring. On the other hand, those which have been left with an abundance of stores are invariably in the best condition in the spring, and commence brood-rearing much earlier than would otherwise be the case.

In districts where thick honey, or honey that cannot be extracted by the ordinary extractor, is obtained, it should be set aside for winter stores, but care must always be taken to prevent any honey from a hive infected with disease being given to a clean colony. It is always a good proposition to extract all the clover or light honey for the market, leaving the darker and stronger flavoured as far as possible for the bees.

DEALING WITH THICK HONEY.

In districts where all or nearly all the honey is too thick to be separated from the combs by the extractor the beekeeper will need to adopt other methods of dealing with it. In the past the method has been to cut it out of the frames and put it through a honey-press, but the honey-melter is now largely used for this purpose. In using the melter it is necessary to see that the honey and wax run away as soon as melted. It is also advisable to allow the honey to cool as soon as possible. For this to be accomplished it will need to run direct from the melter into a separator, which, when full, allows the wax to run off into one vessel and the honey into another. Honey will not be materially affected by the heating, provided it does not remain at a high temperature for more than a few minutes.

In districts producing such thick honey the wiring of frames in the supers may be dispensed with, as it would be a waste of time and trouble to wire them when they have to be cut out to secure the honey. In the past the raising of "section" honey has not been encouraged, but now that the price for this class has improved it may be worth considering if it would not be the best method of honey-production. Where, however, it is possible to produce extractable honey doubtless the latter is still the best paying proposition.

CLEANING UP WET COMBS.

A matter which requires prompt and careful attention is that of putting out the "wet" or newly extracted combs for the bees to clean up. This should always be done at the close of the day, in order to prevent the bees starting to rob. At this time of the year, when the honey-flow is about over, it does not take much to start them. For this reason the honey-house should be bee-proof, and the wet combs be placed on the hives in the evening when the bees have ceased flying. A useful contrivance for the cleaning of wet combs is what is known as the Deadman super-cleaner, which was fully described in the *Journal* for July, 1918. The contrivance has proved very successful in the North Island, but reports from the southern districts tend to show that in some cases where it was used the bees did not work out the outside supers, possibly owing to the weather proving too cold to allow them to do so.

FOUL-BROOD.

At this time, as at all times, the beekeeper will need to be on the lookout for this dreaded disease, and when discovered it should be treated at once. Never allow the bees to go into winter quarters with the slightest touch of foul-brood. Experience has shown that colonies left untreated with but a few cells of foul-brood, even though strong, have almost invariably died out in the spring. The disease makes very rapid progress owing to the young larvæ being fed from the infected stores in the hive. The only safe method is to treat the colony as soon as the trouble is discovered, taking great care to prevent any bees obtaining access to the honey while treating. In autumn and winter treatment it may be advisable to simply shake the bees on to fully sealed frames of honey from a clean hive, and watch for signs of foul-brood in the spring.

VITICULTURE.

S. F. ANDERSON, Vine and Wine Instructor.

THE COMING VINTAGE.

IN this country March is the chief month for the vintage. The main secret of making a good wine is in having good grapes. In New Zealand our wine-grapes never get overripe for winemaking, the chief anxiety of the vigneron being to get them ripe enough. When fit for gathering they should have attained their maximum of sweetness, showing on the hydrometers as follows: Guyot's gleucometre, from 18 to 24 per cent. of natural sugar; if it is the Baume scale, then it should be between 12 and 14 per cent.; if the specific gravity scale is used, then the density should be between 1.090 and 1.108. The Hunter River saccharometer is approximately the same as the Guyot, with the difference that in using the former instrument the temperature of the must is tried when at 80° F. With all the others the test should be at 60° F. or 15.5° C.

As the time for gathering the grapes draws near they should be tried by selecting a few bunches showing an average of the crop. These are pressed out, strained, and put into the test-tube, the instrument floated in it, and the density noted. The general excellence of the wine—in colour, alcohol, acidity, keeping-qualities, and the condition for obtaining a clear, bright sample—depends on the grapes being gathered when at their maximum of ripeness. The acidity of the must need not give the vigneron concern at this stage, as that is always sufficient in New-Zealand-grown grapes.

The dates of commencing the vintage in Hawke's Bay have varied from the middle of March to the middle of April. Only in exceptional years does the grape gain natural sugar after the end of March. The following gives the names of grapes in their order of ripening and the average sugar test of each over a period of nine years: Pineau Noir, 21.5 per cent.; Pineau Meunier, 20.5; Pineau Gris, 24; Shiraz or Hermitage, 17; Cabernet Sauvignon, 18.5; Malbec, 17; Pedro Ximenes, 16; Pineau Chardonay, 16.25; Riesling, 17.

When the fruit is coloured, should the weather be dull and damp, it is a help to its drying rapidly to strip off the lower leaves.

The grapes are generally cut off with small seccateurs or knives into boxes or kerosene-tins, and a great many of the berries fall on the ground. A much better way is to have light trays about 4 in. deep, or milk-dishes. These are pushed under the vines and the bunches dropped into them. At the same time all falling berries are caught in the tray.

As the vintage draws near the vigneron will have a fair estimate of the quantity of wine to be made, and should provide the necessary casks in good time. They are not always to be obtained in a hurry. All the necessary plant should be provided, cleaned, and put into thorough working, hoops driven on, &c. The fermenting-vats require particular attention. More good wine is spoiled by mouldy and bad-smelling casks than would pay for much trouble in these vintage preparations.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

THERE is little requiring to be done at this time in planting and sowing, the principal work being attention in various ways to growing crops.

Turnips may be sown up to the end of March, about the middle of the month being the time most widely suitable. Spinach may also be sown in the warmer districts up to the end of March, but for most places a month earlier is advisable. Sowings of lettuce and radish may be made.

Peas: The earliest crops of peas are secured by sowing about mid-March, a practice applicable only to localities that enjoy a mild winter climate with little or no frost. The purpose of sowing peas in autumn is, of course, to get early crops. Peas do best in a medium temperature, and only do indifferently during the summer months in the north. A fair amount of sunlight and heat is necessary to cause them to pod, and these conditions are not present in most places till the end of October at the earliest. In such places all that autumn sowing can do is to get the plants more advanced in growth than those sown in spring. If sown too early the tops may get too long and become worn by weather. Therefore the last half of May is early enough to sow. In exceptional places, both in the North and the South Island, warmer conditions enable the plants to pod a month or more earlier. From these places the early market is supplied. Sowings are made in March, as already stated above.

In northern districts cauliflowers, cabbages, leeks, and celery may still be planted, and lettuces in all places.

Tomatoes: Keep side growths in strict subjection. Spray with 4-5-40 bordeaux, after rain, or frequently enough to keep a trace of the mixture on the leaves. To conserve the strength of the plants fruit may be gathered when the first faint tinge of colour shows. The fruit is then more advanced than it appears, as colouring begins inside the fruit.

Celery: In most parts of the Dominion celery-growing is not attended with any difficulties, but in the warmer parts it is a troublesome crop to manage. Cool conditions suit celery best, and where such conditions exist very little watering is needed after the plants are established. Where the climate and soil are hot, however, a good deal of watering is required, and rust is often troublesome as well as leaf-spot. Where these diseases have to be contended with the plants should be kept covered with a film of bordeaux or burgundy mixture, the formula being 2-2-40 for lime-bordeaux, or 2-3-40 when soda is used in place of lime, the "3" meaning pounds of soda.

Broad-bean rust: This disease is very troublesome in some parts, so much so that the crop is becoming impossible in certain places. It is useless to try to control the disease unless the source of infection is removed. The disease winters on the old leaves and stems of the plants.

All infected plants should be destroyed by burning, care being taken that no leaves escape the fire. If any of the leaves are ploughed or dug into the ground, or placed on manure-heaps, the disease is sure to recur. Authorities hold that the disease cannot become epidemic if such precautions are taken. Some growers think the disease comes on the seed-beans, but I may mention that a few beans sent here from an infected crop and planted in my own garden resulted in a perfectly clean crop.

Cultivation and fertilizing : Cultivation should be given often enough to keep the surface soil loose and to prevent the growth of weeds, which rob the crops of moisture, usually none too plentiful at this time. The present is a good time to scarify couch and other weeds out of the soil. Cultivation has great effect on the growth of advancing crops, and no one can afford to neglect it. In these days most gardeners have to rely on artificial fertilizers, and these are usually deficient in nitrogen—at least, in a form that is readily available. Crops often are slow in starting, a very undesirable thing at this time, above all others, when the diamond-backed moth is threatening. It is best not to risk a slow start, but to give some nitrate of soda as soon as the plants get hold of the ground after being transplanted. The best way to give the nitrate at this season is in liquid form. Dissolve the salt in water, allowing 1 oz. to each 3 gallons, and give sufficient to moisten the soil around the roots. Nitrate of soda is good for most crops, particularly the cabbage tribe and leeks.

Green-manuring crops : Humus is a necessity to soil-fertility. Where stable or farmyard manure is not available some crop for turning in should be sown on vacant plots. Lupins, field-peas, or partridge peas are more suitable than oats, which latter are most frequently used for the purpose. Land should not be cropped immediately after turning a green crop under. The green matter should have time to decay and the soil to settle down. If a good crop is turned under the capillarity of the soil is hindered for a time, and crops may do but poorly if put in at once.

FORTHCOMING AGRICULTURAL SHOWS.

Broadwood A. and P. Association: Broadwood, 26th February.
 Franklin A. and P. Society: Pukekohe, 27th and 28th February.
 Northern Wairoa A. and P. Association, Mititai: 28th February.
 Waikato Central A. Association: Cambridge, 2nd and 3rd March.
 Taranaki Metropolitan Agricultural Society: New Plymouth, 3rd and 4th March.
 North Kaipara Agricultural Association: Paparoa, 5th March.
 Te Aroha A., P., and H. Association: Te Aroha, 9th and 10th March.
 Hukerenui Agricultural Association: Towai, 11th March.
 Ashburton A. and P. Association: Ashburton, 18th March.
 Hawke's Bay A. and P. Society: Hastings, 23rd and 24th March (Autumn Show).
 Oxford A. and P. Association: Oxford, 8th April.
 Methven A. and P. Association: Methven, 15th April.
 Manawatu and West Coast A. and P. Association: Palmerston North, 22nd to 25th June (National Dairy Show).

(A. and P. Association secretaries are invited to supply dates and location of their shows.)

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COWS AND SOIL-DEFICIENCY.

"DAIRYMAN," Awakeri, Whakatane:—

Since coming to this district my cows have developed a craving for chewing bones, pumice, and wood. I have supplied rock salt, but that has not satisfied them. There is evidently something lacking either in the soil or in the pasture, as most of the cattle in the district seem to have the same craving. Could you tell me of a cure?

The Live-stock Division:—

The craving mentioned is the result of the cattle grazing on pasture lacking in a sufficient supply of one or more of the constituents necessary for rendering plant-growth capable of maintaining the animal's body in perfect health. The trouble is usually met with only on country of a light nature, and more particularly where the pastures have become more or less exhausted as a result of prolonged use without manuring. Where these conditions exist a form of malnutrition affecting cattle, particularly milking-cows, is often met with. The symptoms of this trouble are a stiffness of gait resembling severe rheumatism, and a gradual loss of condition, progressing until the animal becomes very weak and emaciated, in which state it often remains for months, death frequently resulting unless proper treatment is applied. As indicated, when cows develop a craving for chewing bones, wood, &c., it is a sign that the pastures where animals are running should either be renewed or top-dressed with basic slag or other suitable manures. Should your cows develop the symptoms of malnutrition described the following treatment is recommended: Give twice daily 1 oz. of compound syrup of phosphate of iron (Parrish's Food). The syrup should be mixed in about 1 pint of water and sprinkled on sufficient bran to absorb the liquid.

V. P., Devonport:—

HARD BUTTER.

We keep a cow (a Jersey) and make our own butter. It is usually so hard as to be almost impossible to spread it upon bread. Can you please inform me, is there a convenient method of treating the cream or butter to lessen the hardness of it?

The Dairy Division:—

It frequently happens that where butter is made from the milk of an individual cow difficulty is experienced towards the end of the lactation period in producing a butter of normal composition, as at this stage the proportion of harder fats has considerably increased. If the cow is given quantities of succulent feed, this has a tendency to overcome the hardness in the butter. The pasteurization of cream is also helpful in the same direction. This can be done by placing the vessel containing cream in boiling water, allowing the temperature of the cream to rise to 180° F., and then immediately cooling it to a low temperature by placing the vessel in cold water. The cream should be frequently stirred during the process of heating and cooling.

HOME STORAGE OF APPLES.

A. B. MUGGERIDGE, Manutahi:—

Could you advise me as to the best method of keeping apples through the winter?

The Horticulture Division:—

It is, of course, understood that only certain varieties of apples can be kept through winter—namely, those that are naturally keeping-varieties. The fruit should be gathered at the right state of maturity. As soon as it distinctly shows the colour it should have when ripe it is ready to gather, this meaning that the fruit must be mature but not approaching a mellow condition. For this reason a crop should be taken in several gatherings. The greatest possible care should

be taken to prevent bruising. If the fruit is gathered while hot from sun-heat the boxes should be placed in an airy, cool shed where they will be shaded from the sun, and left there until the fruit is cool. The conditions necessary for storing are a low temperature (not freezing), a still atmosphere, and darkness. Some top ventilation is necessary to allow the escape of carbonic-acid gas which rises from the fruit. Storehouses of a number of different designs have been built, such as slab houses thatched with straw, or the entire building constructed of straw packed between wire netting, also buildings of concrete. For the purpose of storing a comparatively small lot any suitable shed or room can be used. The fruit should be paced in bins in bulk, not in single layers, and neither straw nor any such material should be used for laying the fruit on.

DOG WITH SPLIT PAD.

"SHEPHERD," Napier :—

I have a sheep-dog which has split a pad on one of his front feet—probably in fighting. Please advise me how this may be cured.

The Live-stock Division :—

The wound should be thoroughly cleansed with a warm antiseptic solution ; it should then be washed twice daily with a solution of 2 drams of zinc sulphate to 5 oz. water. The foot should be bandaged and kept as clean as possible between the washings.

TAGASASTE SHELTER FENCE.

NORMAN R. WILLIAMS, Hornby :—

Could you tell me how to sow tree-lucerne seed to form a shelter fence ? The fence is intended to cut off the draught which comes under an old row of pines. I intend to plant the hedge about 10 ft. from the pines.

The Horticulture Division :—

The most effective shelter is secured by having the plants in a double row. The rows may be about 12 in. apart. The plants should be 3 ft. apart in each row, and arranged so that those in one row are opposite the intervals in the other row. The seeds may be sown at any time, except perhaps midsummer, when the soil might be too dry. The soil should be well broken up and cleared of weeds. Sow the seed about 1 in. deep, dropping two or three where each plant is to stand, and thin out surplus plants. If the seeds have been stored for a time they should be softened by pouring boiling water on them. Leave them in the water for eight or ten hours, and then sow at once. It is presumed that the plant you refer to is tagasaste (*Citrus proliferus*). The real tree-lucerne is *Medicago arborea*—quite a different plant.

SEGREGATION OF RAM LAMBS.

"CAMPUS," Otaki :—

At what age should ram lambs be segregated ?

The Live-stock Division :—

Ram lambs should be segregated when they reach the age of six months, especially with pedigree stock, in which maturity is reached earlier than with others.

SHELTER-TREES FOR HAWERA DISTRICT.

A. J. HASELTINE, Hawera :—

Please inform me as to the best trees to plant for shelter, the time to plant, and the distance between trees. The ground on which the trees are to be planted is swept by westerly and southerly winds, and also receives a fair amount of salt spray.

The Horticulture Division :—

Pinus muricata is probably the best tree for your purpose, as it stands both wind and salt spray. The best time to plant is July or August, according to the state of the soil. Plant about 8 ft. apart in at least two rows. The trees in one row should be placed opposite the intervals in the next row.

NOTICE.—"Subscriber's" inquiries regarding lucerne and sorrel cannot be answered unless name and address are supplied.

IMPERIAL REQUISITION OF WOOL.

THE following circular, dated 27th January, 1920, has been issued by the Department of Imperial Government Supplies :—

The Department has reason to believe that certain wool-growers are holding back their wool under the impression that it will be free from the Government requisition after 30th June, 1920, and available for private disposition. It is advisable, therefore, to state definitely, for the information of all concerned, that this is not so, and that wool clipped, and wool produced at freezing-works on or before that date, cannot be exported from New Zealand, and that its sale otherwise than to the Government will be an offence. The same position applies to skins from stock slaughtered (other than those at freezing-works) prior to 30th June, 1920. It is requested that brokers and freezing companies take immediate steps to make the position in this respect clear to their clients.

ESTIMATED YIELDS OF WHEAT AND OAT CROPS.

THE following estimated average yields per acre of wheat and oats for the season 1919-20 have been compiled by the Government Statistician, from reports furnished by Inspectors of the Department of Agriculture throughout the Dominion, and issued under date 10th February :—

District.	Wheat. Bushels per Acre.	Oats. Bushels per Acre.
North Island	30.31	35.25
Nelson	19.97	25.00
Marlborough	28.47	43.89
Canterbury	29.16	38.45
Otago	28.89	38.49
Southland	31.76	38.60
Average (estimated) for the Dominion, season 1919-20	29.10	38.35
Average (actual) for the Dominion, season 1918-19 ..	31.57	39.87

In accordance with the above estimates, the total yield of wheat for the Dominion should be approximately 4,100,000 bushels, as against an actual yield of 6,567,629 bushels for the season 1918-19.

The percentage of oat crop threshed in 1918-19 was 35.44 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be 5,575,000 bushels. The oats threshed in the previous season yielded 6,884,609 bushels.

The reports of the Inspectors may be briefly summarized as follows :—

North Island.—Crops in the Rangitikei district (the principal grain-growing district of the North Island) are, generally, in good condition. The cold wet spring, followed by an extremely dry summer, has not been to the advantage of Hawke's Bay. Taranaki is fair, whilst in southern Wairarapa crops are affected with smut.

Nelson.—Fair average crop.

Marlborough.—Generally speaking, an average crop. Heavier lands show greater promise than light, owing to the long dry spell. Some crops discoloured by recent rain.

Canterbury.—Good crops. A late frost was experienced, but the damage done was slight. Rust showing in the northern districts, whilst isolated cases of the disease known as "take all" have occurred in the central and southern portions.

Otago.—Crops generally in good condition, but expected to be late. In Maniototo, Vincent, and Lake Counties crops poor and light.

Southland.—Present weather is not very favourable, and crops are fairly light.

Stud Southdown Rams.—The Department's Ruakura Farm has for sale twenty good-quality two- and four-tooth Southdown rams bred at the farm. Communications should be addressed to the Manager, Ruakura Farm of Instruction, Hamilton East.